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WHY FIRST AID?*

A. WILLIAM REGGIO, M.D.†

BOSTON

THE medical literature is filled with articles about the treatment of injuries and the shock accompanying them. The public expects the physician to accomplish miracles in saving the life of some smashed-up victim or in restoring him to normal again, no matter what the accident or in what condition the patient has been brought to the hospital.

Physicians not infrequently criticize the layman for the way in which such injured persons are brought to them, but, it is pertinent to raise the question, What is the medical profession as a whole doing to improve the first-aid care of the victims of accidents?

The laymen are doing considerably more in that direction than physicians, who as a group, I am afraid, are considerably to blame for this state of affairs. Their greater interest in the treatment of injuries after the victim has been taken to the hospital and their failure to emphasize the care to be given such a person from the very instant after the accident occurs are major factors.

To be sure, more recently, greater attention is being paid to the immediate or first care that these victims require, but most of the emphasis is still being placed on the care that comes after the ambulance has "rushed the victim to the hospital" (with or without police escort).

Although what is done for such patients once they are in the hospital is of the utmost value and deserves much space in the literature, one should not forget that it is to the physician's advantage, as well as to that of the patient, to have these cases brought to the hospital with as little additional shock and damage as possible. Great care should be taken immediately after an accident, and that is when first aid finds its place.

"First aid is the immediate and temporary care given by trained persons in case of accident or sudden illness before the physician takes charge." This definition is taken from a manual‡ recently published by the American Red Cross.

In 1940, there were 8,800,000 accidental injuries in the United States, 93,000 of which resulted in the death of the victim. Of these deaths, 32,600 were due to automobile accidents, and 25,800 to falls. This means that out of 24,000 accidents that occur each day in the United States, 255 of the victims die. As of April, 1941, there were about 186,000 physicians in this country. With 170,000 accidents occurring each week, it would mean that every physician — if all accidents were immediately seen by a physician as the first person to arrive on the scene — would care for 48 accidents a year. Of course, this is quite useless figuring, except so far as it brings out the fact that the great majority of accident victims must receive their first-aid care from a layman who "holds the fort" until the services of a physician can be obtained.

The first-aid care given by a layman often makes the difference between life and death for the victim, and it is reasonable to suppose that a physician will be very grateful that the case has been adequately cared for by some layman, who has thus given the physician a fighting chance to get his patient through alive.

The training of laymen in first aid was begun by the American Red Cross in 1910, when the first class was taught and the first certificates for the successful completion of the course were issued. From 1910 to 1935, the first million certificates were issued, from 1935 to 1939, the second million, and from 1939 to 1941, the third million; and now the number of people asking for and receiving instruction in first aid is nearly double that of a year ago. The fourth million certificates are now

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†Instructor in surgery, Harvard Medical School; assistant visiting surgeon, Massachusetts General Hospital; chairman, First Aid, Boston Metropolitan Chapter, American Red Cross.

‡*First Aid Manual for Civil Defense Units*. 16 pp. Washington: American Red Cross, 1941.

well on their way, 410,966 having been issued during the last twelve months. For the same period, that is, from July 1, 1940, to June 30, 1941, 10,406 instructor's certificates were issued; several thousand additional instructors were trained during this period, but all the certificates have not as yet been issued. Also, as of June 30, there were available for use as active first-aid instructors 30,871 men and women. Most of these are laymen trained and retrained by the Red Cross, but some are physicians appointed by application only.

The American Red Cross offers four courses in first aid. The junior course gives boys and girls from twelve to seventeen years of age instruction in the principles and application of first aid. This course requires a minimum of fifteen hours. Then comes the standard course, which calls for a minimum of twenty hours of teaching and usually requires nearer twenty-five hours for satisfactory completion. The standard course may then be followed by an advanced course, which requires a minimum of ten more hours. Finally, there is the course for instructors in first aid, which requires an additional fifteen hours of teaching after completion of the standard and advanced courses. Both written and practical examinations are given at the end of all these courses and must be successfully passed if a qualifying certificate is to be obtained. Instructors are authorized to conduct the junior, standard and advanced courses, but not the course for instructors, which is given only by specially qualified and authorized instructors approved by headquarters of the American Red Cross in Washington.

There has been and there still is a certain amount of unfavorable criticism and objection on the part of some physicians to the rendering of first aid by laymen. Although poorly administered first aid may be worse than none, proper and adequate first aid, correctly given by a trained layman, may often be the deciding factor between survival and death of the victim of an accident. Of course, there are good first aiders and poor ones, as there are good physicians and poor ones.

Just why this sporadic opposition to the training of laymen in first aid is still maintained by a certain number of physicians is in one way difficult to understand, although in another way the answer is simple. In plain language and without any apologies for making such a statement, the underlying reason for this attitude is ignorance of what first aid really is. They do not know how or what the layman is taught. They criticize the methods taught because these methods do not happen to coincide with what they themselves would do. They have not taken the trouble to find out anything about first aid and not infrequently assume this superior attitude to cover up their own ignorance.

A well-trained first aider can teach a doctor many a valuable trick, provided the doctor is not too superior to be willing to learn from a layman. How many doctors out of the 186,000 in this country are familiar with what is taught in a course in first aid, or are really qualified, offhand, to teach such a course to laymen? It is doubtful if 4 per cent, or about 7500, could do so on the instant, without first learning more about the subject.

Quite a number of physicians who are interested and are willing to be instructors take the standard, advanced or instructor's course to familiarize themselves with the methods they are to teach. It is unfortunate that any doctor of medicine who is a graduate of a Class A medical school, and who is without Red Cross training, may be appointed an instructor in first aid to teach the junior, standard and advanced courses merely on his request for a certificate from the Red Cross. On the other hand, graduates of unapproved medical schools or members of the cults would have first to take the standard, advanced and instructor's courses and pass them successfully, before they could receive a certificate authorizing them to teach.

First aid as rendered by a physician not only may be but frequently is a very sad substitute for what could be done by a trained layman under similar circumstances. Naturally, the layman steps aside when a physician arrives to assume responsibility for the care of a victim, but often the injured person would have received better first aid had the trained layman been allowed to render it instead of the doctor. This is particularly applicable to fractures at the scene of an accident.

Trained laymen know how to use a Keller–Blake leg splint, or a notched board or rake as substitutes, and how to apply fixed traction for safer transportation of the victim. Many physicians do not even know what a Keller–Blake splint is, much less how to apply one, and even less how to improvise or use substitutes.

Another difficulty too frequently occurs during a course in first aid. The class or the instructor invites a physician to attend an exercise and give advice or answer questions. The result is that the physician often condemns traction splinting or some other method of rendering first aid because he, himself, is opposed to such a procedure (or ignorant concerning it), or is personally convinced that a trained layman is not qualified to employ such a method. Of course, it is discourag-

ing to the class and the instructor (who are doing their utmost to be efficient) to be casually informed, with the voice of pseudoauthority, that they are all wrong because that particular physician happens to disagree with or be ignorant concerning methods approved by the American Red Cross, the American College of Surgeons, the Bureau of Mines, the American Association of Railroad Surgeons, the National Safety Council, the National Ski Patrol and numerous similar organizations, to say nothing of physicians outstanding in the field of traumatic surgery throughout the country. The underlying cause of this trouble lies in the fact that medical schools do not teach first aid to their students, and that their graduates consequently know nothing about the subject. It is not the fault of the students but of their instructors.

In a checkup of the medical schools of the country conducted during 1940 by a special committee of the American College of Surgeons, it was found that not a dozen medical schools taught anything about first aid, except for the application of emergency splinting as part of fracture instruction. In half these schools, attending a course in first aid is optional for the students. First aid should be a required course in the first or second year in every medical school.

I take the liberty of quoting two sentences from a personal communication on this matter, since they so aptly bring out the point in question:

> First, it serves to give some practical medical work and useful information to the students in their first and second years that they are able to assimilate at least as well as Boy Scouts and those who attend Mothers' Meetings. In the second place, since many of these boys take positions as camp counselors or camp physicians in their summer vacations, a first-aid course is of more value to them under these circumstances than the other courses of their first two years are: biochemistry, pathology, bacteriology and the *Lives of the Saints* are all of about equal value for a camp counselor and camp physician.

Most medical students and even the younger hospital interns could be put to shame in the rendering of first aid by almost any First-Class Boy or Girl Scout or trained layman.

Physicians should consider honestly whether they are able — offhand — to teach a layman the following procedures of first-aid care according to the standards of the American Red Cross: the prone-pressure method of artificial respiration; detection of the signs and symptoms and first-aid care of snake bite; the application of a Keller-Blake and a Murray-Jones splint; traction splinting with some substitute when these splints are not available; bandaging a hand, ankle or foot with the triangular bandage, open or folded.

It is no simple matter to render adequate first aid on the open road when materials have to be improvised and the complete equipment of a hospital accident room is many miles away. I have seen injured people brought to the hospital who had received first-aid care from a physician, and it has struck me that I should much prefer to have been handled by a well-trained layman under similar circumstances.

This training of laymen should be encouraged, and the physician is the one who can give this encouragement, because in his contact with his patients and with community interests he can, if he will take the trouble to inform himself beforehand concerning it, arouse interest.

All police and fire departments should have their men trained in first aid. This is being slowly accomplished against considerable opposition. One must realize that people taking the course do so voluntarily and usually during their free time, and that there is no financial reward connected with it. It is just one of those unselfish things that may bear fruit if the emergency arises.

The fact has frequently been commented on that when a person knows how to render first aid, it makes him more careful to avoid accidents because, knowing the result of an accident, he is likelier to think twice before running such a risk.

When motoring along the highways, one sees quite a number of signs — usually near gasoline stations — indicating the location of a highway emergency first-aid station under the auspices of the American Red Cross. This means that the men connected with that station have taken the standard course and are qualified and equipped to render first aid when necessary. Many large industrial concerns, gas, electric and telephone companies, department stores — in fact, almost any manufacturing or public-service organization in the country — have a department that concerns itself with the training of employees in first aid. The first step is usually to have a certain number of employees take and pass the standard, advanced and instructor's courses, and then, in turn, give the standard course to other employees.

Another thing that, by the thoughtful co-operation of the press, could be changed is the spectacular reporting of "rushing" injured people to hospitals. The newspapers seem to love the dramatic appeal of this word and fail to realize that, by this excess of speed, not only are other people and vehicles endangered, but the unfortunate victim has shock increased by the joggling

and tossing about that he gets during his ride. If the ride were less hasty and at a moderate, safe speed, — and, if possible, in an ambulance, — the victim would, not infrequently, arrive at the hospital in better shape than when he started. However, the public loves the dramatic whether it costs a life or not.

In the present national emergency, defense councils or committees on public safety have been set up in all the states of the Union. One of their activities deals with the care of the injured as a result of property damage of one sort or another. In connection with this, each community is providing a large number of air-raid wardens, who are to be trained in their particular tasks of coping with property damage and attempting to give the bare essentials of first aid to injured people as well.

In Massachusetts, as a result of the insistent demand of the State Committee on Public Safety, the American Red Cross has added a short course in first aid taught only to persons enrolled as air-raid wardens; this short course in no way supplants the standard course. In fact, all persons taking these ten hours of instruction are urged to follow it up, if possible within six months, with the standard course. The distribution of *First Aid Manual for Civil Defense Units*, printed by the American Red Cross, is confined in Massachusetts to officially recognized defense groups.

Physicians have a firm conviction that "life is more valuable than property," and strive in every way to preserve that life. In the event of an accident, the care or treatment begins at once or as soon as possible after the occurrence. With some 9,000,000 accidents taking place each year, it seems reasonable that physicians should act according to what they say about the value of life — in other words, acknowledge that first aid is worth while. Why first aid? Why NOT?

374 Marlboro Street

THE CARDIOVASCULAR ASPECTS OF AVIATION MEDICINE*

JOHN R. POPPEN, M.D.†

WASHINGTON, D. C.

THE introduction of aircraft into warfare during World War I gave promise that if another cataclysm should eventuate it would have an even more extended application. The present conflict has fulfilled that promise to a greater extent than anyone had anticipated. The prediction that success in war would be largely dependent on aerial supremacy is being vindicated daily. The position of aircraft in the world today is exemplified in the extended interest in aviation medicine displayed by the medical profession. This interest springs not only from curiosity but from a patriotic desire to render to the nation the wholehearted and complete service that is expected of American physicians. It is in times of stress like the present that we of the regular services have to depend on that assistance, and our humble appreciation can be understood.

The problem of the flight surgeon is included in the selection of flying personnel and keeping them in the air.

Aviation medicine is peculiarly subclinical in its field of interest and application. In this respect, it is the acme of preventive medicine. We are most exacting in the choice of our clientele, and the art of our practice is designed to preserve a degree of fitness for a peculiarly exacting mode of life, which is different from and of higher degree than that necessary for any other field of endeavor. For these reasons, it is tremendously necessary for us to have available and make use of any and all armamentaria that will make our selections sound and our practice healthy.

The selection of flying personnel requires, first of all, freedom from organic disease. This is true of the entire economy but particularly so of the cardiovascular system because of the unusual strain to which it is subjected in flying. The heart is insulted by flying. In recent years, we have become more and more impressed with the importance in the development of cardiac disease of what may be called the pace of life. We may differ in our opinions of the relative significance of this factor in the development of, specifically, coronary thrombosis, as compared to infectious disease, heredity, diathesis or other causes, but the fact remains that the incidence of demonstrated coronary disease has risen pari passu with an increase in the tempo of existence in the present highly mechanized and speedy era. Flying is outstandingly of this order. It depends on speed and its concurrent, rapid change of environmental aspect and on the necessity of swift and accurate

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†Commander, Medical Corps, United States Navy; head of Medical Research Section, Bureau of Aeronautics, Navy Department, Washington, D. C.

adjustment to these changes. Whether or not this degree of stress is controlling in the development of organic cardiac disease, it would be folly to permit a person deliberately to subject himself to it if he already has evidence of actual or potential organic disease.

Flying requires adjustment to a new and unusual set of circumstances in its three-dimensional fields. With rapid changes in altitude come the problems of anoxia and high accelerations. The burden on the heart of maintaining adequate circulation in the presence of high degrees of anoxemia is well known. The profound changes in blood distribution incident to the centrifugal forces encountered in certain maneuvers place a peculiar burden on the circulation, in which the heart has its share. The responsibility of repeatedly and suddenly requiring an effort to preserve the circulation against profound reduction and inadequate filling of the right heart is peculiar to flying. These are unhuman circumstances, and for that reason especially trying. They are not reasonable tasks to present to a heart unless it is free from actual or incipient organic inefficiency.

For the determination of actual or incipient organic heart disease, we must depend on the diagnostic methods commonly used in physical examination. Careful history, keen inspection, accurate percussion and clear auscultation continue to be the most reliable diagnostic tools. Adjunctive aids in the form of electrocardiograms and x-ray plates must remain supplementary for those cases in which commoner methods of examination do not suffice to make the diagnosis clear. Under present circumstances, when it is necessary to examine and certify large numbers of flying applicants, it is administratively impractical to include in the records the comprehensive and complete data desirable in a clinical case history or for the preparation of a scientific treatise.

This does not mean that these diagnostic aids should be neglected. The electrocardiograph should have a well-established position in aviation medicine. It would be tremendously desirable to have on record a tracing of every aviator when he begins training. For purely diagnostic purposes and for the detection of arrhythmias, blocks and coronary disturbances, such data would be invaluable. For interpretation in terms of subsequent tracings, taken incident to routine periodic examination or when indicated by intercurrent findings, their value is manifest. It is generally agreed that these original tracings should be made and filed.

Again, taking routine periodic tracings, particularly in certain age groups, would be highly desirable. For a complete record on which to be absolutely sure that the heart continues in high efficiency, such routine examination must be considered indispensable. But the desirability of this procedure must be weighed in the light of administrative capabilities.

To equip all points of original examination with apparatus would seriously tax the industry and would represent an outlay of federal funds that might be justly criticized in time of pressing need for rigid economy. To staff all recruiting stations with trained personnel to make the tracings would require either that civilian institutions be stripped or that intensive training be instituted. To assign to suitable stations enough physicians capable of accurately reading the tracings in the tempo required for defense would deplete the ranks of cardiologists needed by hospitals and educational institutions. How accurate electrocardiographic readings can be obtained on all incoming aviators with sufficient expedition to eliminate those showing sufficient evidence to debar them from flying, not to prevent those whose tracings are well within normal limits to begin training and not to impede a pressing training schedule is a serious question.

At the moment, the problem of fitting electrocardiography into selection of prospective aviators is more urgent than the routine examination of certain age groups. In time of peace, when schedules can be sufficiently flexible to arrange for the transfer of all pilots in certain age groups to central points for electrocardiographic study, the best that could reasonably be expected would be annual examination of pilots over forty years of age. In times of emergency, such as the present, routine stated examinations are virtually impossible. In answer to the argument that one pilot grounded would pay for the procedure, it can be pointed out that separation of a considerable group from points of strategic importance might jeopardize a campaign. The solution to this problem is not apparent. It appears certain that a well-organized and competent program, to effect this desideratum, may have to give way to expediency.

In the choice of selection methods on the personality or psychologic side, we are considerably handicapped by the absence of a good working definition of an efficient pilot. One difficulty in validating tests is the fact that we do not have a negative criterion group. This may be said about all phases of the examination. We do not know, for example, whether epileptoid trends make a poor pilot. It may be pertinent to ask the same question about cardiovascular findings. What degrees of variation from the normal mean electro-

cardiogram may be considered perfectly compatible with flying? Again, should electrocardiographic findings that are regarded as definitely contraindicating certain walks of life requiring strenuous exertion necessarily be considered a cause for rejection for flying?

In discussing the cardiovascular aspects of flying in its application to the maintenance of flying fitness, emphasis will be placed on two major considerations: the cardiovascular demands peculiar to flying, and tests for determining cardiovascular efficiency.

In considering the demands of flying at high altitudes, it is safe to conclude that the burden on the heart and blood vessels is no greater than that introduced by the necessity of compensating for anoxemia or oxygen debt incident to other causes. Some forms of athletic exertion are vastly more demanding than the anoxia of high-altitude flying. Indeed, flying is characterized by an absence of physical exertion commensurate with the situation. This has a specific significance in its biochemical aspects. Emotional stress or a misguided urge to get the most out of oxygen equipment may stimulate hyperventilation out of proportion to that required by the amount of carbon dioxide produced by comparative muscular inactivity. The resulting acarbia may have very serious consequences. But this is essentially a chemical problem and is not appropriate to this discussion. From the point of view of anoxia in high-altitude flying, per se, the cardiovascular demands are not excessive.

A chain of physiologic events incident to rapid changes in the direction of flight may be of interest. These alterations result from the introduction of centrifugal acceleration along the long axis of the pilot's body during certain aerial maneuvers. The attendant symptoms — commonly grouped under the term "blacking-out," and popularly ascribed to the pull-out following a dive at high speed — have been extensively described. The physiologic changes have not been so well described.

The physical force involved is the hydrostatic tendency of the blood to be thrown into the lower parts of the body at the expense of the upper parts. In virtually all aerial maneuvers, the direction of gravitational force is normal in that it applies along the vertical axis of the airplane, which means the long axis of the pilot's body. High accelerations along this axis develop most commonly in the pull-out from a dive and in turns of short radius, such as those seen in aerial combat. In the former, these forces may attain the magnitude of nine or ten times normal gravity (9 or 10 g in gravity units). In the latter, they seldom exceed 5 or 6 g, but are usually of longer duration. Both the magnitude of the centrifugal force and the duration of its application are of critical significance. Thus, the greater strength during a pull-out may be of less consequence than the longer duration during a dogfight. For this reason, it is a mistake to consider the effect only in terms of its magnitude. Indeed, the necessity of guarding against the effects in short radius turns is greater than that in pull-outs following terminal velocity dives. This will be even more apparent when the lesser, subclinical symptoms resulting from the physiologic changes are considered.

In considering the changes in blood distribution, it is well to separate the synchronous changes in the arterial and venous columns. If one regards the arterial column from the cranium to the pelvis as fluid confined in a semielastic tube under a pressure of a couple of pounds per square inch subjected to a centrifugal force downward, it can easily be seen that there will result a tendency toward greater pressure and volume in the lower portion at the expense of the upper. The carotid pressure will drop. The venous column is under much less pressure, and the vessels are less elastic. The changes in the venous column are the same as those in the arterial, with this additional feature: if the gravitational force lasts long enough, the column of venous blood is driven below the level of the right heart. Inadequate filling and reduced output result. The carotid pressure drops, because of the force acting on the arterial column; a secondary and more profound drop, incident to reduced cardiac output, follows. For this reason, the venous changes are of greater importance and constitute a direction of approach in attempting a solution.

Given a profound drop in carotid pressure and a greatly increased jugular suction, one is faced with the question of what happens in the closed cranium. If the cerebrospinal fluid in the spinal column were available, one could expect that the sinuses would collapse with the increased arachnoid filling of cerebrospinal fluid. But the cerebrospinal fluid has the same tendency to leave the cranium because of subjection to the same centrifugal force. If arterial blood were available, one might expect a relative increase in the volume of blood in the arteries to compensate for venous collapse. When one remembers, however, that these changes extend over only a few seconds, it is safe to conclude that there can result no compensatory adjustment in relative volumes of the three fluids within the cranium. This leaves only

one vascular end result: a profound reduction of velocity of flow through the cranium. The symptomatology is easily explicable on the basis of the resultant local, transient cerebral anoxia. This explanation is more tenable than the theory of concussion, of sliding of the cerebrum over the tentorium, with impingement of the posterior cerebral arteries and ischemia of the occipital lobes, or of molecular changes in the neurones or any other theory advanced to explain the symptoms of high acceleration.

There is another feature of the symptomatology that supports the concept of cerebral anoxia and points to its most serious import. The experience of blacking-out in pulling out from a steep dive is strikingly poignant. There can be no doubt that the pilot has been subjected to a force of tangible magnitude. It will immediately cause something in response — often something wrong. But the anoxia has all the attributes of that produced by any other method. It is identical to anoxia at high altitudes, with the sole exception that it is shorter lived. The most dangerous aspect is its insidiousness in degrees below those resulting in subjective symptoms. As a result of being subjected to high acceleration, a pilot may be the victim of decreased mental efficiency well below the threshold of awareness, but particularly dangerous because of this insidiousness.

The desirability of developing means for obviating the effects of high acceleration is manifest. It is regretted that time, inconclusive proof and, possibly, national advantage do not permit extended discussion of these means. Certain procedures have already proved to be partially effective, and there are scientific findings that lead to other possibilities. The answers will, of course, be found.

The cardiovascular problem of maintaining flying fitness is largely that of avoiding the development of what has been variously named but fairly uniformly defined as "neurocirculatory asthenia," "effort syndrome," "soldier's heart" and so forth. I prefer the term "staleness" because it avoids the implication that the condition is exclusively a circulatory disturbance, particularly in its etiology. The psychogenic aspects of its etiology are so strong that the early manifestations may be only changes in emotional and temperamental reaction, which often antecede circulatory changes by an appreciable and important interval.

The condition can be accurately diagnosed in the hospital, but when it has progressed to a degree that makes this possible, it is altogether too late for the flight surgeon. If the condition is to be avoided or relieved before it reaches the stage of hospitalization, it must be disclosed in its earliest and most incipient stages. These patients practically never return to operational flying from hospitals. The task of discovering early evidences and instituting curative measures constitutes the major mission in the practice of aviation medicine.

The competent and experienced flight surgeon, in his capacity of "Dutch uncle" and father confessor, — who lives in daily and nightly contact with his pilots, becomes their confidant and mentor, and is alert to small but significant changes without ostentation, — exemplifies that side of medicine which must always constitute the immediate contact between physician and patient. The principal tools in his armamentarium are his observation, appreciation and compassion. Would that there were more of him today!

During a generation, we have become accustomed to a circulatory efficiency rating using the Schneider index. Six factors — reclining pulse rate, standing pulse rate, increase in pulse rate from reclining to standing, increase in pulse rate following standard exercise, time of return to standing rate, and change in the systolic blood pressure from reclining to standing — are scored on the basis that each is capable of a score of 3. The six are added, giving a total score or index.

The Schneider index has come in for considerable criticism of late, some of it fairly acrimonious. It is claimed that this test does not measure circulatory efficiency. It disregards diastolic and pulse pressures. It gives no indication of circulation time or output per beat. It makes no mention of respiratory indications of circulatory efficiency, such as vital capacity, breath holding and expiratory force. In other words, it is claimed to fall far short of determining what it is supposed to determine.

Before complete condemnation is heaped on the test, however, it may be worth while to consider the use made of it and some of its advantages. In the practice of aviation medicine, the index is applied both in the selection of students and in routine maintenance.

The circulatory efficiency rating is given careful consideration in the original examination. It is seldom, if ever, considered a cause for rejection, per se. If the rating continues low after all possibilities of organic or functional cardiovascular disease have been eliminated and after adequate food and rest have been provided, it must be regarded as an indication of inadequate or unsatisfactory emotional control. If organic disease is disclosed, the disease is considered the cause for rejection. If emotional instability remains as the cause for a low rating and is confirmed by other

findings, the instability is the cause for rejection, and the test falls more properly into the neuropsychiatric examination. A low rating is of considerable value in the original examination.

In routine practice, the Schneider index is commonly taken. It is often performed and scored by trained, enlisted technicians. In these situations, it is considered purely as an index, a cue to further study. If it is low because of rapid pulse, fever or intercurrent infectious illness, the index directs attention to the illness. On the other hand, it may be low because of incipient fatigue or neurocirculatory asthenia. In any event, it is used only as an indication for further study. It is particularly significant in the light of a person's normal average as established during a long period of fitness.

The Schneider index may have many shortcomings as a test of neurocirculatory efficiency. We do not use it as such. It has many advantages. It can be administered by comparatively untrained assistants. Anyone who can count and read a watch and a blood-pressure dial can run the test. It requires a minimum of equipment, and can be completed in ten minutes. It is adaptable to service use, wherever that may take it. It gives very valuable information if properly interpreted.

Finally, it has become a tradition. It pervades the literature and drama of aviation medicine. It is of extreme interest to the pilots themselves. It is one thing to explain to a pilot that his cardiac efficiency has improved, as indicated by increased output per beat, or that his vasomotor control is waxing or waning. It is an entirely different matter to tell him that his index is 10, as compared with his normal index of 14. To personnel trained in accurate mensuration and accustomed to judging on the basis of mathematical readings, a numerical score is tangible and comprehensible. The pilots are sometimes the severest critics of the index. It is completely invalidated when it proves to be high after a bad night. An explanation of the significance of relaxation and composure, coupled with the unstinted confidence of such discussion, serves to cement association, and the index, again, has served a very useful purpose.

Scientific research and study may furnish a much better criterion of circulatory efficiency, but unless it can compete in service adaptability, practicability and comprehensibility, it will encounter opposition in its acceptance.

* * *

The motto of military aviation is, "Keep 'em flying." The service aviators of this country are a choice group of men. They are strong in character, mind and body. They are keen, clear thinkers. They are intelligently critical. They hold a key position in the defense of the nation. They must not be impeded. In all that we do in our mission of keeping them fit to hold that position, we must be scientific, but we must also be practical. Above all, we must not lose sight of the fact that our responsibility is less toward the aggrandizement of general or personal scientific concepts than to the care of the finest group of men in the world. In these days of turmoil and rapidly changing opinion, we must preserve a middle-of-the-road course as mapped by sound, proved facts.

SUPPURATIVE PERICARDITIS*

RALPH ADAMS, M.D.,† AND HUGO POLDERMAN, M.D.‡

BOSTON

THE difficulty of diagnosis of suppurative pericarditis and the general agreement among thoracic surgeons about principles of therapy, although not about details, suggest the desirability of periodic restatement of accumulated knowledge of the disease. Although this report is based on consecutive experience with suppurative pericarditis at the Massachusetts General Hospital during the last ten years, and although the total experience is essential as background, the advances of recent years require a re-evaluation of concepts in relation to the disease and a revision of the therapeutic program in many ways.

The pessimism of the medical profession concerning acute pericarditis was expressed by Cabot[1] in 1926: "We can recognize this disease in only one fifth of the cases and can usually do nothing to cure it. Its clinical importance is therefore small." Winslow and Shipley,[2, 3] in their excellent reviews in 1927 and 1935, however, presented a different picture, at least for purulent pericarditis: about 50 per cent of the cases treated with operation were cured.

A few outstanding facts may be presented at the beginning. The mortality of pericarditis is high because the disease is itself a complication of pre-existing and usually serious infection elsewhere in the body. The diagnosis is difficult and therefore delayed, but the possibility of a favorable outcome is enhanced by early treatment. The only effective therapy is surgical drainage. The recently introduced serologic and chemotherapeutic agents afford additional methods of therapeutic aid that are very promising. A number of articles emphasize the value of surgical treatment of the disease,[4, 5] but it appears from the older as well as from the more recent publications that, even with adequate drainage, only half the patients can be saved. Death is often due to multiple lesions elsewhere in the body, as in staphylococcal and streptococcal infections, or to overwhelming infection and exhaustion, as in pneumococcal infection. Bigger[5, 6] reported 9 operative cases, with recovery in 5. Bunch[7] obtained 2 cures in 4 cases. The numerous reports of single successful cases yield little information about the percentage of cures because single failures are seldom reported. Most of the cases operated on and reported until now were treated before chemotherapy and immunotherapy were generally applied. It seems likely that these forms of treatment may be of great help in the management of purulent pericarditis.

Therapy is discussed in great detail in the following case, for the purpose of emphasizing the advantage of combining all modern therapeutic procedures.

CASE REPORT

CASE 7 (M. G. H. 253933). A 5-year-old boy was admitted to the Massachusetts General Hospital on February 14, 1940, with a diagnosis of bronchopneumonia and pericarditis. Two months before entry, he developed pain in both ears and fever. The middle-ear spaces were drained eventually of staphylococcal pus, with improvement, but a week later, signs of pneumonia appeared. The pulse was 140, and breathing was rapid and shallow. The eardrums were healed. The cardiac percussion area was greatly enlarged, and a pleuropericardial friction rub was heard on the left side. The apex impulse could not be seen or felt, and the heart sounds were of low intensity and muffled. There was a paradoxical pulse. The liver edge was palpable, and there was slight edema over the sacrum. The neck veins were distended. Dullness and absence of breath sounds in the left axilla were indicative of pleural fluid. On x-ray examination, the heart shadow was enlarged, and no pulsations were visualized by kymography. There was a left-sided encapsulated empyema. An electrocardiogram showed tachycardia and elevation of the ST intervals, suggestive of pericarditis.

The pericardial cavity was drained on February 19, without preoperative aspiration. Under local anesthesia, a curved incision was made along the left 7th intercostal cartilage, extending upward to the 5th. The 5th, 6th and 7th cartilages were resected. The pericardium was incised, and 250 cc. of purulent fluid, which had displaced the heart to the left, was removed. The lack of smothered heart sounds, among the classic signs of pericarditis, was explained by the displacement downward and forward of the heart by the pus, which was encapsulated on the right side above and behind the heart. It had collected in a large cavity in the upper right and posterior portion of the pericardium. The adhesions were broken digitally. The pericardium was sutured to the subcutaneous tissues, and a soft tube was put in place, out of contact with the heart. The tube was connected to a drainage bottle protected by a water seal.

The pus contained a Type 1 pneumococcus in pure culture. The patient received multiple transfusions and sulfapyridine. Because his blood serum showed no circulating antibodies against pneumococcus by the Francis test, he was given 20,000 units of Type 1 antipneumococcus serum in sufficient quantities and with such frequency as to maintain a positive test, and the chemotherapy was continued. The empyema cavity was aspirated at intervals. The temporizing procedure of aspirations was elected because the child was too ill to undergo even the simple

*From the Surgical Services, Massachusetts General Hospital.

†Assistant in surgery, Harvard Medical School and Massachusetts General Hospital.

‡Fellow in thoracic surgery, Rockefeller Foundation.

TABLE I. *Findings and Results of Treatment.*

CASE NO.	AGE	SEX	PREVIOUS OR COMPLICATING DISEASE	DIAGNOSIS	SIGNIFICANT CLINICAL FINDINGS	OPERATIVE OR AUTOPSY FINDINGS	OUTCOME	MICRO-ORGANISM
	yr.							
1 (1929)	45	M	Pneumonia 3 mo. before entry, with delayed resolution	Made	Enlarged heart, muffled sounds and distended veins	500 cc. of pus drained at operation; no autopsy.	Death	Pneumococcus
2 (1933)	60	M	Hernia (operation) and bronchopneumonia	Suspected	Friction rub, enlarged heart and distended neck veins	Lobar pneumonia, pleurisy, pericarditis (100 cc. of exudate) and enlarged liver (2000 gm.) at autopsy	Death	Pneumococcus, Type 8
3 (1936)	28	M	Lobectomy for bronchiectasis (several mo. before entry) and residual empyema.	Made	Enlarged heart, paradoxical pulse and positive pericardial tap	420 cc. and 135 cc. of exudate removed by tapping; pericarditis (950 cc. of exudate) and enlarged liver (2200 gm.) at autopsy.	Death	Pneumococcus, Type 8
4 (1937)	65	M	Epidermoid carcinoma of left lung and pneumonectomy.	Suspected	Signs of cardiac failure without electrocardiographic changes	Pericarditis (150 cc. blood-tinged fluid) and enlarged liver (metastasis) at autopsy	Death	Pneumococcus, Type 1
5 (1937)	2/3	F	Otitis media, pneumonia and empyema (drained)	Made	Enlarged heart, dysphagia and positive x-ray evidence	400 cc. pus drained at operation; pericardium well drained at autopsy.	Death	Pneumococcus
6 (1939)	1/26	M	Pneumonia, otitis media and empyema	Suspected	Precordial friction rub	Pericarditis (few cc. of exudate), left pleural exudate and lung abscesses at autopsy	Death	Pneumococcus, Type 23; *Staphylococcus aureus*.
7 (1940)	5	M	Pneumonia 3 wk. before entry; empyema.	Made	Enlarged heart and liver, muffled sounds, paradoxical pulse, positive x-ray films and electrocardiograms, sacral edema and engorged veins	250 cc. of pus removed at operation	Recovery	Pneumococcus, Type 1
8 (1929)	18	M	Pneumonia 1 wk. before entry; pleural effusion.	Made	Enlarged heart, muffled sounds, feeble pulse and distended abdomen	Large amount of pus removed at operation	Recovery	*Staphylococcus aureus*
9 (1930)	19	F	Osteomyelitis of left thigh (drained) and other foci	Made	Friction rub and positive pericardial tap	50 cc. of pus removed at operation; well-drained pericardium and small necrotic abscess in heart muscle at autopsy.	Death	*Staphylococcus aureus*
10 (1931)	5	M	Osteomyelitis of tibia (drained) and meningitis	Suspected	Terminal friction rub	Pericarditis (75 cc. of turbid fluid), myocarditis, multiple miliary abscesses in liver, spleen, kidneys and lungs, and small patch of endocarditis at autopsy	Death	*Staphylococcus aureus*
11 (1935)	10	F	Osteomyelitis of femur (drained)	Made	Friction rub, absent apex beat, distant sounds and paradoxical pulse	Large quantity of pus removed at operation; well-drained pericardial sac at autopsy.	Death	*Staphylococcus albus*
12 (1933)	58	M	Cholecystitis and rupture of subphrenic abscess into pericardium	Not made; operated on for embolus.	None	Large quantity of pericardial pus at operation; communication with subdiaphragmatic abscess at autopsy.	Death	*Staphylococcus aureus*
13 (1938)	22	M	Chronic osteomyelitis, with multiple foci	Not made	None	Pericarditis (50 cc. of fluid), abscess in heart muscle and amyloidosis at autopsy	Death	*Staphylococcus aureus*
14 (1939)	3	F	Abscess of thigh (drained), abscess of lung and pneumothorax	Not made	None	Pericarditis (100 cc. of fluid), 0.5-cm. abscess in right ventricular wall and enlarged liver (8 cm. below costal margin) at autopsy	Death	*Staphylococcus aureus*
15 (1939)	40	M	Pneumonia and sepsis	Not made	None	Pericarditis (15 cc. of purulent fluid) and abscess in heart muscle at autopsy	Death	*Staphylococcus aureus*
16 (1939)	38	F	Chronic osteomyelitis (multiple sinuses)	No pericarditis	None	Myocardial abscess (without exudate in pericardium) and amyloidosis at autopsy	Death	*Staphylococcus aureus*

TABLE 1 *(Concluded).*

CASE NO.	AGE	SEX	PREVIOUS OR COMPLICATING DISEASE	DIAGNOSIS	SIGNIFICANT CLINICAL FINDINGS	OPERATIVE OR AUTOPSY FINDINGS	OUTCOME	MICRO-ORGANISM
	yr.							
17 (1932)	19	M	Pneumonia, empyema and lung abscess (?)	Suspected	Muffled sounds and signs of enlarged heart	Pericarditis (100 cc. of turbid fluid), interstitial edema in muscle, bilateral lung abscesses and enlarged liver (2800 gm.) at autopsy	Death	*Streptococcus haemolyticus*
18 (1934)	48	F	Chronic sepsis, otitis media, mastoiditis and skin ulcers	Not made	None (tender right costal margin)	Pericarditis (50 cc. of purulent fluid), heart muscle not involved; thrombosis of liver and pancreas.	Death	*Streptococcus haemolyticus*
19 (1935)	61	M	Pneumonia and empyema	Suspected	Enlarged heart and muffled sounds	Pericarditis (100 cc. of fluid), in pericardium, sac thickened to 4 mm., extension from pleura, and enlarged liver (2140 gm.) at autopsy	Death	*Streptococcus haemolyticus*
20 (1937)	2	F	Pneumonia 2 wk. before entry	Made	Enlarged heart, muffled sounds, paradoxical pulse and positive x-ray evidence	300 to 400 cc. of fluid removed at operation, with drainage of retropharyngeal abscess and other foci	Recovery	*Haemophilus influenzae*

maneuver of trochar thoracotomy. Two weeks after pericardiotomy, the residual empyema was drained by rib resection. The patient gradually improved, and was discharged in good condition on April 27. His health has remained excellent since discharge, and he is leading a normal life.

Comment. Pericardiotomy in this case may be regarded as a lifesaving procedure, but should be recognized also as merely an incident in a therapeutic program that would have failed had not the additional aid of immune serum, chemotherapy, transfusions and excellent nursing care been supplied. At the time of operation, the child was seriously ill, but there was no disease of consequence in the lung. The empyema, as well as the pericarditis, was postpneumonic. This sequence is of less serious import than the concurrent appearance of the complication with intrapulmonary lesions, and may account partially for the favorable outcome. Incidentally, this patient was the third to recover from pneumococcal pericarditis in the hospital records.[8, 9] Other cases, even after early and adequate surgical drainage, had always run a discouraging course of continued weakness and increased infection, and after a period of 2 or 3 weeks, the patients died. The presence of empyema as an additional burden has been cited frequently in the literature as highly unfavorable prognostically.

Pericardiotomy was performed in 2 other patients with purulent pneumococcal pericarditis (Cases 1 and 5, Table 1). The drainage of 500 cc. of thick pus in Case 1 and 400 cc. in Case 5 may have resulted in temporary periods of improvement, but failed to change the progressive course of the disease. Both cases are illustrative of the steady decline in general condition that often typified cases of pneumococcal pericarditis, even after drainage, in the years before chemotherapy and immunotherapy became available. The patients in the remaining 4 cases of pneumococcal pericarditis died without operation.

The pericarditis in 9 cases was due to *Staphylococcus aureus* infection, and operation was performed in 3 of these cases, with recovery in 1. Pericardial drainage was without question a lifesaving procedure in this last patient (Case 8), but was postponed until he was almost moribund. The error was largely due to failure to suspect the diagnosis, for the recorded observations indicated the presence of pericardial effusion for many days before it was recognized clinically. Although drainage of the pericardial cavity was adequate in each of the other 2 operated cases (Cases 9 and 11), infection elsewhere was too severe and extensive for a fatal outcome to be prevented. An interesting finding in 1 case was an abscess in the heart muscle, which Nikolaew[10] also considered. Similar myocardial abscesses were discovered in 4 of the 8 fatal staphylococcal infections. In another case (Case 16) worthy of mention in this series, an abscess was found in the left ventricular wall containing thick yellowish pus and presenting against the epicardium but not accompanied by exudate within the pericardial cavity. The occurrence of an actual abscess in the myocardium, without an exudative response in the immediately adjacent pericardium, must be extremely rare.

Three patients died of streptococcal infection, and no operation was performed in this group. One case (Case 19) illustrates the fact that signs of pericardial effusion can at times be produced by a small quantity of fluid, only 100 cc. being found at autopsy. Inability of the pericardium to dilate, owing to preceding inflammatory fixation in association with empyema, is the probable explanation.

In 1 case (Case 20) of influenza-bacillus infection, the patient survived following pericardiotomy.

Discussion

Even a casual perusal of these cases reveals that suppurative pericarditis finds its most frequent precursors in staphylococcal and streptococcal bacteremia and in pneumonia. Of the 20 cases, 12 were preceded by pneumonitis or pneumonia, 6 by osteomyelitis, 1 by cholecystitis, and 1 by mastoiditis. In the case following cholecystitis (Case 12), the pericardial infection was obviously secondary to perforation of a subphrenic abscess into the pericardium. Ochsner and DeBakey,[11] in reviewing 3608 cases of subphrenic abscesses, found a perforation into the pericardium in 71.

One case of streptococcal pericarditis (Case 19) was probably due to direct extension from a nearby streptococcal abscess in the pleura. In the 2 other cases, the method of metastasis, whether by extension directly, by blood stream or by lymphatic flow, is uncertain. The coexistence of myocardial abscesses in 4 staphylococcal cases and the presence of myocardial abscess in 1 case without concurrent pericarditis indicate the poor prognosis that must be anticipated in staphylococcal pericarditis even after drainage of the pericardium. Such abscesses were not found in infections from other organisms. In none of these cases had the abscess perforated either into the ventricle or into the pericardium, and the case of myocardial abscess without pericarditis suggests that pericardial effusion need not be considered a sequel to abscess. Unfortunately, in no cases in which a myocardial abscess was discovered post mortem had an electrocardiogram been taken. Attention is called particularly to the diagnostic help that might be available from this laboratory method, because in these cases electrocardiographic changes seem to be likely.

Suppurative pericarditis occurred in 12 patients under thirty years of age and in 8 over thirty. Fourteen patients were males, and 6 were females. These figures parallel very closely those derived for age and sex incidence from collected statistics.

Diagnosis

The difficulty of diagnosis is apparent from the difference of incidence in the figures of the pathologist and the clinician. However, the likeliest cause of this discrepancy is the failure of clinicians to keep in mind the possibility of pericarditis and to seek the signs that suggest it in any case of infection not progressing satisfactorily.

Frequent careful evaluation of the area of cardiac dullness and the character of the heart sounds is extremely valuable in the early detection of this complication. Muffled heart sounds due to accumulated fluid are a sign that can be supported by x-ray examination, and fluoroscopy is more helpful than film. Not only can diminished or absent pulsations be observed, but alteration in configuration of the cardiac shadow with changes in position can be discovered, as Holmes[12] pointed out; this is a very useful sign.

Kymography furnishes information about the amplitude and character of cardiac pulsations and thus indicates tension within the pericardial sac, but the data from kymography are not always conclusive. The diminution of pulsations is not a sign restricted to pericardial effusions, and Freedman[13] has also observed it in decompensated hearts and in cases of myocardial disease. Berner[14] describes the discrepancy between pulsations of the ventricular wall and those of the aortic knob as being of differential value. In pericarditis, the pulsations of the knob are very distinct, with decrease in movements of the heart itself, whereas in decompensation the weak heart action has an equal effect on the pulsations of both structures. Sufficient observations are not yet available to allow evaluation of this sign.

A number of authors[15-17] have considered the electrocardiographic changes occurring in acute pericarditis. The changes consist in elevation of the RST segments in Leads 1, 2, 3 and 6, and a depression in Leads 4 and 5. These alterations are usually transient, and last not longer than two weeks, after which the most constant change is an inversion of the T waves. These abnormalities can be confused with those of infarction of the myocardium, but when the electrocardiogram is carefully studied in conjunction with the clinical facts it may contribute valuable help. The changes are believed to be due to alterations in the subepicardial muscle layers, and not to the pressure of the exudate, and they are therefore of little value as an actual indication for operation.

Auxiliary signs of great diagnostic value, when present, are a paradoxical pulse, engorged neck veins, an enlarged liver, sacral edema and a pericardial friction rub. The last is transitory. Its presence means much, its absence little. Some degree of cyanosis and respiratory distress is almost constantly observed. The paradoxical pulse is not always easy to feel, but with the help of a blood-pressure cuff the difference during inspiration and expiration can be made more obvious. When the pressure in the cuff is gradually raised, one finds a point where the pulsations during inspiration will just be suppressed.

Treatment

The mechanical problems of pericardial effusion are different from those encountered in pleural effusion. In the latter, the tendency is to delay operation until the fluid becomes frankly purulent, and until one can expect that enough adhesions have been formed to prevent collapse of the whole lung. The quantity of fluid is, as a rule, not the deciding factor. In pericardial effusion, however, it is mainly the pressure of accumulated fluid that jeopardizes the life of the patient. To control the situation with aspiration is less satisfactory and more dangerous than in pleural effusion. It sometimes happens that the pus is present in a pocket behind the heart, as was true in Case 7, and attempts to aspirate in such conditions will necessarily fail and carry a great risk of injury to the heart. A few cases have been reported in which repeated taps were sufficient to cure even a purulent pericardial effusion,[9, 16] but pericardiotomy is the more reliable procedure. For example, 1 patient (Case 3) was treated by pericardial aspiration because the fulminating progress of the infection and the desperate condition of the patient caused the surgeon to think that pericardiotomy would be a procedure of greater magnitude than the patient could undergo safely. Perhaps so, but it should be noted that 950 cc. of fluid remained in the pericardium after aspiration, and that needle aspiration almost uniformly fails to save the patient.

It is difficult to estimate how much fluid must accumulate in the pericardial cavity to create signs of cardiac tamponade. Slowly developing exudates can reach a quantity of 600 to 700 cc., and sometimes even more, without pressure signs. However, when fluid accumulates rapidly, as with blood in heart wounds, 100 to 200 cc. can give symptoms of severe tamponade. In acute pericarditis, a relatively small amount of fluid can interfere significantly with the circulation. White[18] stresses the engorgement of the veins and enlargement and tenderness of the liver as early signs of pericardial effusion. That this can occur with relatively small amounts of exudate can be seen in 3 cases (Cases 17, 18 and 19), in which only 100 cc. of exudate was present and in which the liver was enlarged and heavy, with the edge well below the costal margin. In cases in which the fluid has not become purulent, one can expect a change every day, and even in these, pericardiotomy is considered by some[6] to be better than waiting, with or without aspiration.

Opening the pericardium is not a difficult procedure, and enough experience has accumulated to show that exposure of the heart to atmospheric pressure is almost without danger, and certainly less dangerous than exposure to a positive pressure in a closed pericardium. Whether or not a pericardial tap should be performed before operation depends largely on the certainty of diagnosis. The needle is still a blind instrument, and accidents have been reported; however, applied with skill and care, such a tap may yield valuable information. Every effort should be made to avoid infection of the pleura, and for this reason the parasternal approach seems to be the most logical. The technic of pericardiotomy naturally varies with the surgeon. The left parasternal approach used in Case 7 is recommended as simple, safe and effective. Bigger[5] and Bunch[7] also advocate this approach. Moore[19] describes the advantages of a posterolateral dependent drainage, which we believe carries great risk of infecting the left pleural cavity. Goinard[20] describes median and subcostal epigastric routes of approach, which are satisfactory.

Prognosis

The prognosis of purulent pericarditis depends largely on the collateral foci of disease; untreated purulent effusion into the pericardium, however, has a 100 per cent mortality. When operation is performed, the chances for recovery increase to about 40 or 50 per cent. From the literature, it seems that pneumococcal pericarditis has a slightly better prognosis, but the present group is too small to warrant any suggestion in this regard.

Fear formerly existed that these patients would develop constrictive pericarditis. This has not happened, however, and probably need not be anticipated unless the effusion is due to tuberculosis. Operation in one case (Case 8) in this series dates back to 1929, and this patient is now in excellent health. A second patient (Case 20) is also in good health three years after operation. A third patient (Case 7) was treated only sixteen months ago and is in excellent condition, but the period of observation is too short to be called an end result.

Cause of Death

The patients who were not operated on died for various reasons. In many, the bacteremia was overwhelming, and in others the small amount of fluid could scarcely have been responsible for death. In some of the cases, however, early pericardiotomy might have changed the course of events.

Summary and Conclusion

Three cases of purulent pericarditis are described in which cure was obtained by operation. In the description of a case of purulent pneumococcal pericarditis, emphasis is placed on the com-

bination of surgery, immunotherapy and chemotherapy as being responsible for the recovery. Sixteen other cases of suppurative pericarditis are described.

In 5 cases of staphylococcal pericarditis, an abscess was found in the heart muscle; a suggestion is made concerning electrocardiographic studies in such cases.

It is shown that in purulent pericarditis small amounts of fluid, by their rapid accumulation in an unyielding pericardial sac, can give severe signs of heart tamponade.

Problems of diagnosis and treatment of suppurative pericarditis are discussed.

It is concluded that a less pessimistic attitude toward suppurative pericarditis is possible in the light of recent advances in immunology and chemotherapy.

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ACTIVITIES OF THE BOSTON HEALTH DEPARTMENT*

G. Lynde Gately, M.D.†

BOSTON

IT is significant to note that men of influence in the early history of Boston gave attention to the prevention and control of disease. Health, history and heroes are bound in one. Our predecessors blazed a trail that has not only kept Boston in the forefront of American municipalities in matters affecting public health, but has left a path that sanitarians of other cities in later years have safely followed.

Many of the men of those early days that we remember through our school histories have their names in the annals of health in this section of the Commonwealth. I have in mind Samuel Fuller, Governor Winslow, the Reverend Cotton Mather and the president of Boston's first Board of Health, Paul Revere. Dr. Samuel Fuller came over on the Mayflower in 1620, and his wife, Bridget Lee, acted as nurse in his professional work in ministering to the colonists.

As early as 1639, Massachusetts provided for the registration of births, deaths and marriages.

In 1647, an act of the legislature against the pollution of Boston Harbor was passed. Statutes that required the isolation of the sick and interesting local regulations adopted in accordance therewith were promulgated in Boston and Salem as early as 1678, so that the attempt to check the spread of communicable diseases is nothing new.

In 1721, the efforts of Zabdiel Boylston and the Reverend Cotton Mather to provide inoculation against smallpox were treated with derision, but Dr. Boylston was later rewarded by being made a fellow of the Royal Society of London.

The Acts of 1799, Chapter 10, empowered "the Town of Boston to choose a Board of Health for removing and preventing nuisances."

In 1816, a law was passed by statute to permit the inhabitants of Boston to choose one able and discreet person from each ward to be a member of the Board of Health.

On December 2, 1872, the mayor was vested with the power to appoint a board of three commissioners to exercise the functions of the Board of Health.

The activities of the Board of Health were originally much more extensive than they are at present; for example, they included the collection of ashes and garbage, which was finally delegated to the Department of Public Works, where it properly belongs.

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†Commissioner of Health, City of Boston.

In 1894, Boston was the first city in this country or abroad to establish, through its health department, a system of daily medical inspection of children in all public schools. At present, the Health Department prepares daily a list of all the communicable diseases reported for the calendar day, a copy of which is sent to all schools, hospitals and interested institutions in the city. In this way, the School and Health departments cooperate in the proper control of such diseases.

Aside from these functions, which properly belong to the Health Department, there are in Boston certain other phases of health work that in other cities are under the direct supervision of the health departments, but that in Boston are under the control of separate departments. I refer to the registration of births, deaths and marriages, to the hospitalization of diseases of all kinds, particularly communicable diseases and tuberculosis.

The Health Department is composed of the following divisions, as provided by city ordinance: Vital Statistics, Communicable Diseases, Laboratory, Tuberculosis, Child Hygiene and Health Units, Housing and Sanitation, and Food. The Milk Inspection Service is regulated by statute law. The following services have been established within the department: dental, nursing, health education, dairy and abattoir. The department sponsors three WPA projects: an eye-conservation program; a nursery-school program, carried out on the roofs of the Health Units; and a physical-examination program for welfare recipients and WPA workers.

Each of the major divisions is now headed by a deputy commissioner. Since each unit is a decentralized health department, I am desirous of changing this setup, so that there would be only one deputy health commissioner, who would be in charge of the Division of Child Hygiene and Health Units. The rest of the department should be divided into bureaus, with a director in charge of each.

The following are the activities of the major divisions of the Boston Health Department.

Division of Communicable Diseases. This division deals with the control of reportable diseases, including work incident to lapsed and incorrigible cases of syphilis and gonorrhea and the follow-up of cases for required treatment and hospitalization. Cases of food poisoning are investigated by this division, which also furnishes death certificates in cases in which the medical examiner declines jurisdiction. This division approves licenses to conduct maternity hospitals and homes for the reception of women during pregnancy and investigates day nurseries. Supervision of the rabies problem by the quarantine of animals is carried out as one of its functions. The veterinarians of this division make annual inspections of cattle, goats, sheep, swine and fowl for the purpose of detecting the presence of contagious disease in animals.

Laboratory Division. The laboratory provides diagnostic laboratory examinations for diphtheria, tuberculosis, gonorrhea, syphilis, dysentery, malaria, streptococcal infections and Vincent's disease; it performs guinea-pig inoculations for the determination of diphtheria virulence and of the presence of tubercle bacilli in body fluids; and it conducts bacteriologic examinations of raw milk, water from swimming pools and beaches, and food. Suitable outfits are provided to physicians, clinics and hospitals for collections from patients of specimens or materials to be submitted to the laboratory for bacteriologic, microscopic or serologic examination. The laboratory is also the distributing center for Boston of the biologicals produced by the Massachusetts Antitoxin and Vaccine Laboratory. The volume of annual performance has increased notably in serologic procedures, owing to the venereal-disease program. The pending standardization of all laboratories by the Massachusetts Department of Public Health has resulted in an evaluation study of both Wassermann and Hinton findings in a series of routine blood specimens, with the possibility that the latter method will ultimately be adopted as an accepted routine test. In 1940, about 68,000 examinations were made.

Tuberculosis Division. The aim of this division is the discovery of cases of tuberculosis and the supervision and disposition to sanatoriums of cases that require treatment. Thirteen diagnostic clinics have been established at strategic points throughout the City. There are twenty-three weekly sessions. The clinics are manned by a group of fifteen physicians, and the attendant service is supplied by the Nursing Service. When hospital disposition is recommended, each case is looked into by the settlement investigator. Boston-settled cases are admitted to the Boston Sanatorium, and State-settled cases are sent to state sanatoriums. Two pneumothorax clinics are held each week. X-ray films are taken of every patient on the initial visit, and repeat films as often as necessary. This x-ray service operates in eight units, and in addition carries out necessary x-ray and fluoroscopic study at the pneumothorax clinics. A weekly nose and throat clinic is held at the Concord Street Unit. Lamp treatments are given to patients with lymph-node infections; Wassermann tests are made on all adults, and Von Pirquet skin-reaction

tests on all up to seventeen years. In 1940, there were 1245 cases of pulmonary and extrapulmonary tuberculosis (1030 resident and 215 nonresident), and 167 cases of childhood-type tuberculosis. There were 456 deaths from pulmonary and extrapulmonary tuberculosis (419 pulmonary and 37 extrapulmonary). There were 904 admissions to hospitals. In the clinics, there were 22,510 examinations, 6698 x-ray films, 2031 Von Pirquet tests, 1270 Wassermann tests and 639 lamp treatments. There were 3834 pneumothorax treatments.

Division of Child Hygiene and Health Units. During the past year, twenty-nine weekly conferences were held in the seventeen baby and preschool stations located in the Health Units, municipal buildings and settlement houses and staffed by pediatricians from Harvard, Tufts and Boston University medical schools. The medical inspectors participate in the conferences in the Health Units. Six thousand four hundred and eight newborn babies were registered at our clinics last year, as well as 308 children from one to two years of age, and 260 between two and five years. The number of newborn registered represents about 40 per cent of the total births in 1940. Medical inspectors made 224 visits to day nurseries. The physical condition of the children was checked, and vaccinations and immunizations were performed.

Division of Housing and Sanitation. The following are some of the activities of this division: routine inspections of tenement houses, three-family houses, private lodging houses and public lodging houses; observation of offensive trades; control of smoke and fume nuisances as related to public health; enforcement of the law relating to surfacing, grading and draining of private alleys; enforcement of building laws relating to public health; supervision of swimming pools, wading pools and beaches, including the taking of samples of water for analysis; rat and vermin control; supervision of conditions along the waterfront; licensing and maintenance of dumps; and survey of plumbing in buildings, including cross connections and inspection of water in dwellings.

Food Division. The work done in this division includes control and supervision locally over the sale, production and manufacture of food, drugs and so forth. The Food and Drugs Law, to prevent misbranding of food and drugs, is enforced by this division. Wholesale and retail store inspection, market and bakery inspection, and regular inspection of food establishments requiring licenses are made by inspectors of the division. The control of vehicles used by itinerant peddlers of fish, fruit and vegetables, as well as the fruit and vegetable terminals and the Boston Fish Pier, comes under it. The City is divided into fourteen districts, and the districts are divided into routes. The inspector is able to cover one route each working day. The "Saturday" market is efficiently handled by this division. The stands and peddlers must pass a rigid examination, which also applies to meat and poultry. Co-operative work is also done with the United States Food and Drug Administration.

Dental Service. Dental clinics are held daily in eight health units and two stations from 9 a.m. to 4 p.m. (Saturdays from 9 a.m. to 12 noon). Three days a week are allotted to the children of the public schools, two days to the children of the parochial schools, and Saturday morning is an open clinic for preschool children and emergencies. The attendance during 1940 was 75,523; the number of patients was 38,755; and the number of operations was 127,606.

The regular dental personnel is augmented by the services of five dentists and two hygienists of the WPA.

Nursing Service. A policy of generalized nursing has been carried on, and the nurses are assigned to various districts on the basis of need. Under this plan, nursing service is provided for the Communicable Diseases, Child Hygiene and Tuberculosis divisions, including clinic service and necessary home visits. The nurses also give service to parochial schools and day nurseries.

Nurses' visits to cases of communicable diseases in 1940 amounted to 26,710. Visits in the field include follow-up visits on all children attending the twenty-nine weekly conferences held in seventeen different stations throughout the city; and visits to newborn babies to ascertain their need of health supervision were also made. On December 31, 1940, there were 26,727 children under the supervision of our nurses.

Nursing service is given to all but one of the forty-eight parochial schools in Boston, with a school population of 26,275. Five thousand eight hundred and ninety-two visits were made to parochial schools in 1939, and 5210 in 1940.

Nurses assist in the selection and transportation of children to and from the dental clinics.

Twenty-nine day nurseries and nursery schools are given health service by the nurses, and 1286 visits were made to those groups in 1940.

All reported cases of tuberculosis and their contacts are supervised by the nurses until there is some good reason for discontinuing this service. On December 31, 1940, 27,239 patients and contacts representing 8582 families were under the supervision of the nurses. There were 9782 dis-

charges during the year, but there were also 1116 readmissions and 4525 transfers from one district to another. In 1940, the nurses made 123,792 visits to tuberculous patients and their contacts.

Field training is provided for students attending the School of Public Health of Simmons College.

I consider it worth while to correlate the evolution of Boston's public-health program during the last fifty years with the improvement in health conditions that is reflected by the constant reduction of morbidity and mortality, and I shall present some vital statistics from the reports of the Boston Health Department, which furnish a reasonable cross-section of prevalent health and disease conditions in many parts of the United States for the periods enumerated. The mortality rates from specific causes may be considered typical, by and large, for the country as a whole.

Particular attention is called to the encouraging figures that reveal the halving of the general death rate during the last half-century. It is also pleasing to call attention to the tremendous reduction in the tuberculosis death rate and in the deaths from diphtheria, typhoid fever and scarlet fever. Contrasted with this improvement, deaths from heart disease have more than doubled, and those from diabetes and cancer have almost tripled.

What is the comparative picture? In 1940, there were about 50 deaths per 100,000 inhabitants from pulmonary tuberculosis, 0.8 from scarlet fever, 0.3 from diphtheria, and 0.1 from typhoid fever.

In 1890, with a population of approximately 450,000 as contrasted with the present population of about 800,000, there were actually 400 deaths in Boston from diphtheria, as against 2 in 1940; 41 from scarlet fever as against 9; and 155 from typhoid fever as against 1. If the infant death rate prevalent in 1890 were applied to the number of live births in 1940, there would have been 2600 deaths of children under one year of age, as against the 764 that actually occurred.

What have been the results of this half-century of public-health effort in Boston? As already mentioned, the span of life has been materially lengthened; the death rates from all causes have been almost halved; the infant mortality rate has been reduced by 75 per cent, that of tuberculosis by 89 per cent; diphtheria and typhoid have almost been eliminated as causes of death in the community; deaths from scarlet fever have become negligible.

What have been the changing practices that have brought about this remarkable improvement? Hermann M. Biggs, to whom we owe a great deal for the development of administrative technic in the field of public-health administration, proclaimed that public health was purchasable, and that within reasonable limitations, communities might determine their own death rates. By this statement, he meant in substance that the wise expenditure of adequate funds for the conduct of essential public-health activities would markedly control the prevalence of preventable diseases and deaths from many causes. What are these activities that he had in mind, and what part have they played in influencing the health of the American people? I have already mentioned the significant effect of the application of sound procedures for the sanitation of the environment, the protection of water and milk supplies and the control of communicable diseases. The place of the laboratory as a significant component part of a modern health department has been amply illustrated. The value of immunologic agents has been demonstrated beyond measure as a factor in the prevention of disease.

Very fortunately for organized society, this century has been marked by a number of significant public-health movements, which have required the participation of the individual. The child-hygiene movement, the campaign for the control of tuberculosis, the mental-hygiene movement and the social-hygiene movement, waged by official and voluntary agencies, have stimulated the imagination of the American people, and have resulted in higher standards of individual and community health. Clinics of various types, carrying on the functions in the above-mentioned fields and having for their objectives the prevention and control of disease, have become increasingly utilized by armies of people, who have demonstrated by their reaction the belief that an ounce of prevention is worth a pound of cure.

One should call attention to the significant relation between satisfactory prenatal care and maternal and infant welfare. Studies carried on in Boston have proved that the death rate among expectant mothers receiving adequate prenatal care is about half that among those lacking such medical supervision. Prenatal care has done much to reduce the hazards of the toxemias of pregnancy, injuries at birth and prematurities, and to lower deaths among infants. There is, however, much room for further improvement in reducing deaths occurring during the first month of life.

Both voluntary and official agencies have concerned themselves with the problem of infant, preschool and school-child health. Milk stations and

baby and preschool clinics have served as the headquarters for the dissemination of information, and for the education of mothers in the very best methods for keeping children well. Among the administrative methods for the conduct of this work has been a co-operative plan developed in Boston, between the Health Department and the Harvard, Tufts and Boston University medical schools, whereby pediatricians from the teaching staffs man the clinics and are reimbursed by the Health Department. Advantage is taken of the presentable opportunity for teaching medical students preventive pediatrics.

It is in the fields of child health and tuberculosis that the public-health nurse has made a lasting contribution. Newborn babies are visited shortly after birth by nurses of the Health Department, and mothers are urged to take their babies either to their own family doctor or to the clinic for periodic medical supervision. Here, children are examined, vaccinated against smallpox, and immunized against diphtheria. Breast feeding is stressed, and whenever possible the use of pasteurized milk and the preparation of the proper formulas are taught. When children arrive at the preschool age, the so-called "neglected age," every effort is made to maintain the continued interest of the parents in the physical and mental health of the child. There is, however, room for much further progress in this age group.

One is familiar with the frequency with which faulty teeth, defective vision, defective hearing, malnutrition, faulty posture, functional or organic heart disease and occasionally tuberculosis are found among the school-child population. Large sums are being spent in the United States for the medical inspection of schools and physical examinations for the discovery of remediable defects. Emphasis should be placed on the value of increasing efforts for the correction of defects found. An example of excellent service in this field is the program carried on by Dr. James A. Keenan, his school physicians and nurses in the Boston Public Schools; the Health Department assumes the responsibility for medical inspection in the parochial schools.

The care of the mouth and primary teeth is receiving fitting recognition. It is hoped that what is being done for children today in the way of preventive dental care may bring about higher standards of dental health for the American people. An outstanding example of municipal interest in this field is the program of the Health Department, whereby a corps of approximately twenty dentists and ten hygienists of the Forsyth Dental Infirmary carry on prophylactic dental service in the Health Units. This personnel is reimbursed from tax funds.

Attention is being given to the subject of proper nutrition as a factor in normal growth and development, to the eradication of faulty food habits and to the establishment of proper and well-balanced diets.

The attack against tuberculosis represented what may be termed the second important public-health effort at the beginning of the present century. Case-finding, the isolation of the infected person, the rounding up of contacts who have been exposed, occupational adjustments and pneumothorax are all a part of the modern campaign for coping with this problem. Today, every health department of appreciable significance either maintains, or sees to it, that there exist in the community adequate facilities for tuberculosis control.

For a number of years, the subject of the control of venereal diseases was approached, except in rare cases, with much diffidence and hesitation. Gonorrhea and syphilis represent an important public-health problem. Stimulated by the efforts of the National Society for Social Hygiene, and more recently by the vigorous challenging efforts of Surgeon General Thomas Parran, and with the assistance of federal funds, a worth-while program is constantly making further progress. The Massachusetts Department of Public Health, with the aid of the above-mentioned funds, not only assists in the maintenance of a number of venereal-disease clinics, but stimulates the upholding of adequate standards. Of particular significance is the organization of facilities for rounding up the lapsed cases.

During the present century, there has been an increasing recognition of the relation of housing to health and the control of disease. It has been recognized that adequate light, air and ventilation and the avoidance of overcrowding are minimum requirements in the field of human needs.

There is a need for an increased recognition by those responsible for community health of the problems of mental hygiene and mental disease. A ray of hope is offered by the expansion of the child-guidance clinics conducted under official or voluntary auspices, which deal with the problem of faulty habits in children and the need for the improvement of the environment to which the child is exposed. Certainly, the tragically high prevalence of mental disease should focus attention on the need of more prevention.

Vigilant health officers appreciate the value of an understanding by the public of the functions and objectives of the Health Department. Healthful living needs interpreting in simple, understandable language. The spoken word in the clinic, in the lecture hall and over the radio, and the visit of the public-health nurse can be opportunely utilized for educational health propaganda. The leaflet, the poster, the pamphlet may all serve the useful purpose of making people more health-minded. Here and there, health educators employed by health departments are living examples of changes in public-health practice from police methods to education.

As deaths from preventable causes have been lessened and the average span of life increased, many persons are living to middle and later life, with a consequent increase of the diseases prevalent in the older groups. Among these illnesses are cardiovascular disease, cancer and diabetes. This newer public-health problem should be the concern of the health officer. Although this does not imply that he must necessarily conduct medical activities for the treatment of these diseases, it is his obligation both to educate the public in methods for their control and to see that there are in his community an organized medical profession, clinics and hospitals to cope with these problems.

The health officer today integrates the efforts of administration — the findings of the statistician, the medical inspector, the public-health nurse, the milk, food and sanitary inspector, the laboratory technician and the school physician — with those of the representatives of the voluntary health agencies. Today, in cities of varying size, health services are frequently conducted on a district basis. Radiating from the health centers, which were founded to bring together under one roof in a spirit of service and of team play all concerned with the problem of health and welfare, these services attempt to present a united front against sickness and death.

Statistical figures that corroborate the assumption that improvements in health result from changes in public-health practices tell but a part of the story. Even more can be done. There are still too many deaths from preventable causes. Health workers can add more years to the span of life and improve the span of health, since the knowledge and methods at their disposal possess rich, lifesaving values. They must create, by education and by the conduct of adequate programs, a greater desire on the part of everyone for life's most treasured possession — optimum physical and mental health.

Since I have been health commissioner, I have been very fortunate because of the establishment of the Advisory Council, composed of leaders in the fields of public health and medicine and of representatives from the voluntary agencies, under the able leadership of your president, Dr. George C. Shattuck. Each of these leaders is to make a special study of a division or service of the Health Department, and will make recommendations that will result, I am sure, not only in improvement of efficiency, but also in raising the standard of performance. This council has had two meetings so far, and I can honestly report a true spirit of co-operation and progress in the right direction.

In the Laboratory Division, we are making some special studies in whooping cough, and also working out a new method for gonococcus culture and diagnosis as a part of the program for the control of venereal disease. In the Milk Inspection Service, we have succeeded in obtaining the co-operation of all the milk companies supplying Boston, so that by July 1 of this year, we should have 100 per cent pasteurization of the Boston milk supply.

In the interest of national defense, the Boston Health Department, through its Laboratory Division, has recently co-operated with the Government in performing thousands of blood tests for selectees and the National Guard. In conjunction with the Massachusetts Department of Public Health, the Tuberculosis Division has x-rayed several hundred selectees. This year, I earnestly hope to set up, with the co-operation of the State Department of Public Health and with the help of federal funds, a greatly improved and enlarged health-education program, as well as a much more comprehensive program for the control of venereal disease.

I compliment all the private and voluntary agencies in the City of Boston, many of which are housed in the Health Units, for I honestly believe that in no other city is the relation between the Health Department and these agencies more pleasant and more harmonious.

It would be in poor taste for me to make any presumptuous claims for the Boston Health Department, but I should like to emphasize that I know of no perfect performance by any health department, and I am of the sincere conviction that the combined performance of the Boston Health Department and the voluntary health agencies compares favorably with that of any other large city in the country.

SPONTANEOUS MEDIASTINAL EMPHYSEMA*

CHARLES W. STYRON, M.D.†

BOSTON

SPONTANEOUS mediastinal emphysema should always be considered in the differential diagnosis of pain in the chest, because if the diagnosis is missed, a grave prognosis may be given for a benign condition.

The history of the pain associated with spontaneous mediastinal emphysema may well be consistent with coronary thrombosis, pericarditis, ruptured or dissecting aneurysm, mediastinitis, pulmonary embolism and spontaneous pneumothorax.

The syndrome may occur at any age, usually in a healthy person, with or without exertion. The onset is frequently alarming and dramatic, with sudden precordial or substernal pain, shortness of breath and cyanosis. The pain may be slight or quite severe, and it may be necessary for the patient to remain in one position for relief. He may feel or hear a peculiar grinding or crunching in his chest with each heart beat, with swallowing or with change in position. The pain may gradually subside within a few hours or may persist with exacerbations and remissions for a variable period. The patient may recover completely, only to have the same train of symptoms recur after a few weeks, months or years.

On physical examination, the patient usually appears comfortable except for the pain. The temperature, as a rule, is normal, with normal or slightly elevated pulse and respirations. Dyspnea and cyanosis are sometimes present. Certain important physical signs are found. Dullness to percussion over the left border of the heart is diminished or absent. Bubbling, crunching and gurgling to-and-fro sounds are heard over the precordium. These sounds are altered by change in position, and may cease with the disappearance of pain. Signs of pneumothorax may be found, but the pneumothorax is frequently so small that changes are not apparent on physical examination. Occasionally, air may appear under the skin of the neck or above the clavicles.

The diseases that are confused with spontaneous mediastinal emphysema are, as a rule, readily differentiated. The history alone may be sufficient to make the diagnosis, particularly if the patient is conscious of these gurgling, crunching sounds, with relief on change in position. The presence of air in the subcutaneous tissues of the neck or periclavicular regions is helpful. Previous adjacent operation may be the cause of mediastinitis or pericarditis, and infection or operation at a distance, by subsequent thrombophlebitis, may produce pulmonary embolism. Small infected emboli may produce mediastinitis, with or without concomitant pulmonary infarction. The presence of fever and leukocytosis and characteristic electrocardiograms serve to differentiate coronary thrombosis and pericarditis. X-ray examination may be essential, however, if obvious signs are not brought out on the first examination. Subfascial emphysema, often present after artificial pneumothorax, need not be confusing.

Hamman[1, 2] is credited with calling attention to the uncommon syndrome that bears his name. He was able to prove some of his cases either by x-ray or by subsequent clinical course, in addition to the characteristics mentioned above. Morey and Sosman[3] reported a case in a young man in which there was a small pneumothorax. They stated that the disease may occur as a result of coughing, in asthmatics, in labor, after trauma and operation, and following artificial pneumothorax. They mentioned the possible necessity of incising the neck to release the accumulated air. By overdistending the lungs of cats and other animals with a truncated catheter, Macklin[4] has shown that air dissects into the perivascular sheaths and travels along these sheaths to the mediastinum, thus producing a mediastinal pneumothorax. Clinically, this condition may occur when the alveoli are subjected to abnormal pressures in the closed method of anesthesia, in infection with bronchial or bronchiolar obstruction, and in pathologic conditions of the heart and great vessels. The dissection of air may extend to the opposite lung, to the abdomen (to produce a pneumoretroperitoneum), to the neck and to the periclavicular regions. Scott,[5] Faulkner and Wagner[6] and Caldwell[7] have written on the subject. Caldwell mentioned a traumatic case due to a stab wound, in which the patient was found to have typical signs the day after the accident.

CASE REPORTS

CASE 1. J.C., a 33-year-old man, was quite well until April 15, 1940, when, while walking, he was seized by a gripping pain in the midscapular region that radiated

*From the First Medical Service, Boston City Hospital.

†Formerly, house officer in medicine, Boston City Hospital; fellow in medicine, George F. Baker Clinic, New England Deaconess Hospital.

around to the precordium, up to the left shoulder and, finally, down the left arm to the wrist. The patient was unable to get his breath, felt weak, and was forced to sit down. He dared not move at the time for fear of aggravating the pain and, indeed, feared that he was going to die. The pain lasted about 3 hours, at the end of which he was brought into the hospital. He remembered having had a somewhat similar pain 12 years previously.

Physical examination showed an asthenic young man lying quietly. He was apprehensive. The face was flushed, the tongue was tremulous, and the trachea was in the midline. The left chest was somewhat full anteriorly. Expansion was equal, and both lung fields were resonant. Breath sounds were normal. The left border of the heart was 9.5 cm. from the midsternal line. The heart rate was regular and rhythmic, and a faint systolic murmur was heard at the apex; a faint transient, grating sound was heard in the tricuspid area.

The blood pressure was 140/80, the temperature 97.8°F., the pulse 65, and the respirations 22.

At the time of examination, the patient was thought to have a coronary occlusion. He continued to have substernal pain off and on for 2 days. On the 3rd hospital day, the patient complained of a to-and-fro thumping noise. The sound was easily heard at a distance of several feet from the chest wall. When a stethoscope was placed on the precordium, very loud crunching, bubbling sounds were heard. The sounds altered markedly with change in position, and were best heard on the left side. The same phenomenal sounds were heard at a later time. In the course of a few hours, the sounds disappeared permanently.

Three electrocardiograms at intervals of several days were normal. Westergren sedimentation rates at 3-day intervals were 1, 6, 8, 6, 4 and 5 mm. at the end of 1 hour. The white-cell count was never over 6800. Serologic tests were negative. The nonprotein nitrogen was 26 mg. per 100 cc. A 7-foot x-ray film of the chest was within normal limits.

The patient was followed at monthly intervals for a year and had no recurrence. Repeated electrocardiograms were normal.

Although no x-ray evidence of a pneumothorax was found, it was concluded that the signs described above were so typical as to furnish unmistakable evidence of mediastinal emphysema. Furthermore, the clinical diagnosis was certainly supported by laboratory studies.

CASE 2. F. M., a 22-year-old man, was well until August 31, 1940, when, while walking along the street, he felt a stabbing precordial and left-sided chest pain. He became short of breath and had to sit down for relief. He was brought to the hospital. Following arrival, he remained fairly comfortable.

The patient seemed rather frightened but felt generally well. His color was good. The trachea was questionably deviated to the right. Expansion of the thorax was equal. The lung fields were resonant. Breath sounds were slightly diminished high in the left axilla and at the left apex posteriorly. The left border of the heart was 8 cm. from the midline in the 5th interspace. With the patient in the recumbent position, the heart sounds were regular and rhythmic, with a very faint scratching sound characteristic of a friction rub. However, when he was turned on the left side, loud, crunching, bubbling, gurgling, to-and-fro sounds were heard and were audible to the patient. The sounds were easily heard a foot and a half from the chest wall without the aid of a stethoscope. In addition, the patient noticed some pain when he was placed on the left side.

The blood pressure was 120/80, the temperature 98°F., the pulse 70, and the respirations 20.

A 7-foot chest plate revealed a small pneumothorax at the left apex; the pleural surfaces were separated at the apex by 1.3 cm. No air was seen in the soft tissues. An electrocardiogram was normal, and other laboratory data were within normal limits.

The patient remained quite comfortable after the first few hours in the hospital. Twelve hours after admission, no unusual cardiac sounds could be made out. He was seen in the Outpatient Department a month after the episode, and reported that he had been well.

SUMMARY

A brief discussion of spontaneous mediastinal emphysema is accompanied by a short review of pertinent clinical and experimental literature, and 2 cases are reported.

372 Longwood Avenue

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MEDICAL PROGRESS

OVULATION

JOHN ROCK, M.D.*

BROOKLINE, MASSACHUSETTS

UNTIL very recently, medical students were taught that at birth the fetal ovary contained all the primitive follicles that would ever appear, that thenceforth no more eggs would be developed from the germinal epithelium. This view is no longer tenable. Studies of Allen and Creadick[1, 2] on the mature mouse and of Evans and Swezy[3] on the rat, guinea pig, dog, cat and man show that from birth to the climacteric, cell division in the germinal epithelium constantly produces new cells, which move centrally into the stroma. In man, these are, before migration, differentiated into ova and follicle cells. This proliferation of germinal cells depends apparently on an intrinsic urge to grow that is characteristic of all living tissue. The primitive follicles, with a similar growth potential, increase in size; and, including those of early embryonic origin, they secrete estrogen, which directs the secondary sex development. Even before birth and continuing until puberty, some follicles enlarge to the appreciable diameter of several millimeters, while estrogen production increases. All the follicles, however, stop short of complete growth. Around each, the theca interna, which is clearly derived from the ovarian stroma, remains rudimentary, and so far as is known, except in very rare and abnormal instances, the nucleus of the ovum does not divide, nor does the ovum escape. During prepubertal life, there is a constant regression of the larger follicles and their ova, as well as a growth of the smaller and younger ones.

With puberty comes a change in the secretion of the pituitary gland which results in a reduction of the rate of ovogenesis.[4, 5] Of greater import, however, is the advanced growth that occurs in those ova and follicles already present. Fevold, Hisaw and Leonard[6] have separated the maturity principle from the anterior lobe into a follicle-stimulating hormone and a luteinizing hormone. By action of the former, many follicles increase in size, and the production of estrogen mounts; by action of the latter, the theca interna surrounding the granulosal cells develops into a luteal layer, which contains fat droplets and which undoubtedly secretes progestin. When this occurs, the ovum, also in response to these two hormones, possibly assisted by a thyroid secretion, undergoes its first reduction division and extrudes the first polar body.[7] Ordinarily, in the human female, such stimulus from the pituitary gland is sufficient for, or is accepted by, only one of the many ova in both ovaries. As this one ovum matures, its growing follicle, now encased in an active luteinizing theca interna, migrates to the surface of the ovary. Secretion of follicular fluid continues; intrafollicular pressure rises.[8-10] The cortical covering of the follicle suffers pressure ischemia at one point; the theca interna bulges through as a small nipple, and finally the thinned-out wall of the follicle ruptures. The follicular fluid escapes, washing out the cumulus and its contained ovum.[11] Thus, ovulation is accomplished.

With the extrusion of the ovum, and the evulsion of some, if not all, of the granulosal layer, the theca interna closes the ostium and, as some believe, in conjunction with the remaining granulosal tissue, develops rapidly into the new master gland, the corpus luteum. This potent gland of limited life, in addition to estrogen, secretes progestin, which is chemically somewhat similar to estrogen but pharmacologically quite different from it.

Before the rupture of a chosen follicle is due, — that is, during the preovulatory phase of follicular growth, — many grossly discernible follicles in one or both ovaries contain normal ova surrounded by proliferating granulosal cells. This doubtless indicates that the enclosed ova are also progressing toward maturation. Ordinarily, however, only one apparently forms a polar body and is liberated. After this event, the proportion of degenerating and atretic ova increases.[12, 13] Pincus[14] states that in mammals "mature ova retained in the ovary at the time of ovulation ordinarily degenerate." Meiotic division has been reported in a human follicular ovum at a time when a secretory endometrium gave evidence of corpus-luteum activity.[15] This, however, may represent an early step in the breakdown of the egg, since, as Pincus[16] states, "the atresia of ovarian eggs is often initiated by the formation of a maturation spindle."

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*Research associate in obstetrics and instructor in gynecology, Harvard Medical School; visiting surgeon, Free Hospital for Women.

Ova that do grow following ovulation regress before the maturation stimulus from the pituitary comes again after menstruation.

It is clinically very significant that during the activity of the luteal tissue, which begins shortly before ovulation,[17] no further normal maturation of other ova takes place. When the corpus luteum regresses and progestin diminishes, a new crop of partially developed ova and follicles begins advancing toward maturity.

To clarify some later considerations, it is well to review the physiology of menstruation. Estrogen from the follicles stimulates the endometrium to grow — to proliferate. The stroma becomes thicker; the arterioles increase in size, and the capillaries in complexity; the glands become larger and more numerous. The histologic picture of both the glands and the stroma is well known and characteristic.[18–20] At the time in the menstrual cycle when progestin, elaborated by the corpus luteum, becomes effective, the proliferated endometrium is said to become "secretory": it "functions." This secreting or functioning mucosa likewise has a histologic appearance that, conversely, specifically indicates progestin activity. The human corpus luteum ordinarily functions only just before and for two weeks after ovulation. Enough progestin to elicit the cytologic picture of beginning secretion in the endometrium is usually produced during about the second twenty-four hours after ovulation. The cytology of this continuing functional phase exhibits a well-known orderly and progressive series of stages each of which individually possesses distinguishing features. Thus, by examination of a biopsy specimen and recognition of any one of the stages, the observer may estimate how long progestin has been acting, and therefore how long the corpus luteum has been present. And so, by the endometrium, one may estimate when ovulation took place.

If conception and implantation have not occurred, the activity of the corpus luteum finally ceases, and the potentiality to bleed, which has been developed in the endometrium by estrogen and kept from expression by progestin, is released by withdrawal of the progestin.[21] As a result, blood is extravasated into the tissue. This disintegrates and menstruation ensues.[22]

Tests for Ovulation

Are there any means, besides endometrial biopsy, by which one can tell whether and when ovulation, that event of such potentially tremendous import to the individual and to society, takes place? Of the numerous tests that have been proposed, the following are the most popular ones.

Mittelschmerz

Some women experience with ovulation a momentary lancinating pain in either lower quadrant, usually superimposed on preceding dull discomfort of several hours or even days. Wharton and Henriksen[23] state that the pain is usually so mild as to be undetectable until after educated attention has been directed to it. Ito[24] reported that 70 per cent of a group of female medical students and physicians were able to detect ovulation by their subjective symptoms, whereas only 40 per cent of nurses in the series studied were able to do so.

In Boston, surely not more than 15 per cent of women receive such information. This discrepancy is presumably not due to territorial favoritism on the part of Nature, but may indicate a lack of particular education and attentiveness. Doubtless, many hitherto heedless women could be trained. Although the information is very useful, distressful confusion might arise in many emotional females from intensively applied abdominal introspection. However, the method has merit and should be more commonly applied.

Intermenstrual Bleeding

In 20 per cent of the cases studied by Wharton and Henriksen,[23] the *Mittelschmerz* was accompanied by intermenstrual bleeding profuse enough to require protection. More commonly, bleeding at the midcycle arises unassociated with pain. The flow varies considerably in amount. Sometimes, it appears merely as a pink or brownish stain in mucus. In his study of intermenstrual bleeding in macaques, Hartman[25] found that, when bleeding occurred at ovulation time, it was usually in microscopic amounts. Wharton and Henriksen microscopically examined the vaginal washings of 5 women with no gross bleeding and found blood in all. Papanicolaou[26] also noted that almost 24 per cent of vaginal smears taken on the fourteenth day contained microscopic traces of blood. This flow at ovulation time is sufficiently gross to attract the attention of probably less than 5 per cent of women.

Biochemical Study

In many laboratories, efforts are being made to measure in blood and in urine the amounts of female sex hormone — the combined estrogens. When the values obtained for estrogen content of urine for several unit periods of twenty-four or forty-eight hours throughout the cycle are plotted

against time, curves are obtained that are considered typical of the ovulatory cycle. Although the absolute amounts of total estrogen in the urine may vary in assays by different chemists, there is a semblance of uniformity in the curves. Those of Gustavson et al.[27] do not reflect the findings of Smith and Smith[28] that a marked peak is demonstrable twelve or thirteen days before the next catamenia, but their published curves do show peaks between the fourth and twenty-first days before menstruation. Werner[29] also comments on the appearance of an estrogen peak at about the middle of the cycle, and its reduplication a few days later. Furthermore, Gustavson states that in every case the estrin excretion falls to zero at or very shortly preceding the next ensuing menstrual period.

Kurzrok, Kirkman and Creelman[30] reported the sudden appearance of the follicle-stimulating hormone (prolan A) in the urine, usually about the middle of the menstrual cycle. Using a more sensitive method, D'Amour[31] and Werner[29] obtained values for urinary gonadotropin throughout the cycle. In the majority of their cases, the resulting curves showed a peak about sixteen to twelve days before the succeeding menstruation.

Another biochemical measurement — that of the excretion in the urine of pregnanediol, a breakdown product of progestin — is also informative.[32] When pregnanediol first appears during the cycle, one may assume that the corpus luteum is in the ascendancy, since, in the absence of conception, progestin (containing progesterone) comes only from the corpus luteum.

Collection and delivery of many specimens of urine or blood entail much inconvenience, and the chemical analysis requires much time and expense, as well as a rare degree of skill. The determination of hormone content is therefore still to be considered a research method, and is of relatively little value for the clinical problem of detecting ovulation.

Basal Body Temperature

Rubenstein[33] proposes that, in normal women during the childbearing period, rectal temperatures taken at the same time each day and under standard basal conditions vary characteristically during the menstrual cycle, and if plotted against time describe a specific curve informative of ovulation. His proof that the selected portion of the curve truly denotes ovulation depends to some extent on a few pregnancies that have followed coitus at this time but, more especially, on a change in the quality of epithelial cells recovered from the depths of the vagina. This change he sees occurring synchronously with what he considers to be characteristic variations in temperature. It would seem easy for patients to read and record their rectal temperatures at the same hour every day, but I must confess my inability to recognize in more than one of the few curves obtained from my patients the particular series of variations of from less than 0.5 to 1°F. or slightly more that are taken to indicate ovulation. Since the accuracy with which patients can determine and record rectal temperatures at particular times under particular conditions is questionable, and especially because variations of so slight a degree are incident to so many conditions besides ovulation, this method does not appear to be a reliable one for determining the time of ovulation.

Vaginal Smears

In 1917, Stockard and Papanicolaou[34] presented their pioneer work relating changes in the vaginal epithelium of guinea pigs to the estrous cycle. On this groundwork, a very large part of modern sex endocrinology has been built. In 1933, Papanicolaou[26] described a method of obtaining the vaginal desquamate of women and of staining a spread of the cells. He designated the varying qualities of the stained smear as indicative of definite sequential phases in the ovulatory cycle of the human female. Many ardent workers have used his method and learned much about the effect of estrogen on the vaginal epithelium. From smears, one can usually detect the failure of the ovaries to form many active follicles, as in some cases of amenorrhea and in the menopause, and likewise discover the presence of many follicles secreting estrogen in the ovulating woman. In smears, one also detects the effect of the relatively enormous amount of estrogen secreted by the placenta in pregnancy. Few, however, and I am not one of them, have been able, with Papanicolaou's stain, to see changes specifically indicative of ovulation on or about the day it occurs. Hence, as a method of detecting ovulation, the vaginal smear is yet of very limited, if any, clinical value. Great conservatism in its use is also advised by other investigators.[35, 36]

A new method of staining vaginal smears recently described by Shorr[37] may prove helpful. By its use, one can demonstrate ovulatory changes in the macaque.[38] In the macaque, however, ovulation is associated with exceedingly gross alterations in the tissues of the vagina and vulva, which are only very faintly simulated in the human female. It seems to me that variations in the vaginal desquamates during the human cycle are equally slight.

Biopotentials

In 1935, Burr and his collaborators[39] reported that, with ovulation in the rabbit, there was a demonstrable increase in the difference in potential between two electrodes, one placed above the symphysis and the other in the vagina. Reboul, Friedgood and Davis[40] repeated Burr's experiment and furthermore discovered by direct observation that this change in biopotentials was synchronous with ovulation. In 1937, Burr and his associates[41] reported a similar phenomenon in one woman. This was also demonstrated in one case in my clinic.[42] Rock, Reboul and Snodgrass[43] later reported changes in difference of potential at the time of ovulation in 9 other women, but because 3 of these were found at operation to be only on the verge of ovulation, it was proposed that the recorded increase in the difference of potential was merely *associated* in some way with ovulation. This conservatism was supported by Rogers's[44] observation that a similar change in biopotentials was obtained in the spayed rat during the last day of estrogen-induced estrus. However, in 1940, Barton[45] suggested that wide changes in the difference of potentials between two index fingers indicated ovulation. Furthermore, she concluded from her data that ovulation might occur at any time during the cycle, and sometimes twice in the same cycle. Impressed by the facts that the abdominovaginal sign was obtained sometimes before and sometimes with or after ovulation, that its polarity was inconstant and, particularly, that there were wide variations in the magnitude and duration of the change in difference of potential, Snodgrass[46] attempted to discover something more about the cause of these potentials. Very significantly, he found that the potentials between fingers were affected proportionately by changes in the environmental temperature of one finger. It was also noted that daily differences in potentials between fingers were very probably influenced by atmospheric temperature and humidity affecting the body as a whole.[46, 47] Finally, of great clinical value is the fact that, contrary to Barton's findings, rather intensive study in my clinic proves that the so-called "finger-to-finger potentials" have no relation whatever to ovulation. As the complete report of our researches has not yet been published,[48] I take this opportunity to say that, like basal body temperatures and vaginal smears, biopotentials may be affected by ovulation but not in such a critically peculiar way as to indicate ovulation, and therefore, like the other methods, cannot be used clinically to detect this significant event.

Endometrial Biopsy

Is there *any* dependable means of telling whether or not ovulation takes place? I referred above to the fact that estrogen alone causes a proliferation of the endometrium that results in a characteristic cytologic appearance, and that, when progestin comes into action, function or secretion is evoked in the proliferated tissue, again with a typical cell picture in the glands and later in the stroma. By aspiration into a small suction curet of a fragment of endometrium before an expected catamenia, one may, after section and staining, determine whether or not progestin has been elaborated in the ovary.[20, 49, 50] If the signs are there, one may deduce the presence of a corpus luteum, and hence that ovulation has taken place. At present, endometrial biopsy is the best clinical test for the occurrence of ovulation.

Time of Ovulation

So regular are the successive changes in the functioning endometrium as the secretion of progestin waxes with the growth of the corpus luteum and wanes with its regression, that one may discover not only *if* ovulation occurs but also approximately *when* it occurs.

In the first years of this century, the prevailing view among biologists was that the egg was released about the time of menstruation.[51–53] Recently, Barton[45] deduced from observations of finger-to-finger potentials, which I consider not at all indicative of ovulation, that in 18 per cent of them (24 per cent in a smaller series[54]), it occurred in the midcycle, but in the rest at any time in the cycle, even during menstruation. Rubenstein[33] believes that he has demonstrated by changes in basal body temperatures and vaginal smears, both of which I consider misleading or uninformative, that ovulation usually takes place near the midcycle, but may occur at other times, even during the menses. By correlation of observations of the ovaries at laparotomy with the anticipated dates of catamenia, Ogino,[55] on the other hand, convinced himself that ovulation occurs between the sixteenth and twelfth days before menstruation; and Knaus,[56] by observation of the myometrial response to posterior pituitary extract as affected by progestin, concluded that it takes place on the fifteenth day preceding the onset of the menses. By correlation of the age of the corpus luteum (as evidenced in the stage of endometrial functioning detected by biopsy) with the date of the subsequent menstruation, in more than 400 biopsies in my clinic, we have, in about 75 per cent of these, placed maturation of the ovum

and probable ovulation at the sixteenth to the twelfth day before the onset of menstruation. At present, by more accurate reading of the endometrial section, in about 90 per cent of cases it is possible to foretell within about two days when, in the absence of pregnancy, menstruation will occur. The calculations are based on the assumption that the corpus luteum functions for about two weeks, and the accuracy of prophecy bespeaks the soundness of the theory. In the few remaining cases, the question may well arise whether or not something is wrong with the hormonal control of endometrial bleeding, rather than whether or not ovulation takes place at the time indicated by the degree of progestin effect.

By applying this proposition to the prevention of pregnancy, we believe we have proved, as many others have, that ovulation normally occurs about fourteen days before the succeeding menstruation. Allowing three days for the effectiveness of spermatozoa and an admittedly long period of three days for the susceptibility of the egg to fertilization, we have reduced the fertility rate among 109 women from 90 pregnancies per 100 person-exposure years to only 4.[57] The proposition that the ovum is freed on about the fourteenth day before menstruation cannot be far wrong when coitus is freely practiced at other times by 109 very fertile women and so very few of them become pregnant. The exceptions are properly explained by the impossibility of always accurately placing the next menstruation.

It should be noted that I do not say that ovulation occurs about the fourteenth day of the cycle. From our biopsy studies, we are convinced that in cycles varying in length from the ordinary twenty-seven days, that is, in cycles that terminate with menstruation on the twenty-eighth day, the variable is in the follicular (proliferative) phase — the period following catamenia. The luteal or secretory phase is relatively constant, varying from 12 to 16 days. On the basis of controlled mating experiments in the chimpanzee, Elder[58] in like manner emphasized the importance of taking into account the length of the cycle when estimating ovulation time: that is, he found ovulation to take place earlier in short cycles than in long ones.

Failure of Ovulation

Since long before the suggestion in 1908 by Hitschmann and Adler[59] that the ovary might have a causal relation to cyclic changes in the endometrium, the occurrence of uterine flow has been regarded as a sign that ovulation had taken place, and amenorrhea has been considered evidence of its failure. It is now known that neither of these views is strictly tenable. In only 1 among more than 400 biopsies, have I seen evidence of a corpus luteum, bespeaking ovulation, in a patient who did not, in the absence of pregnancy, subsequently menstruate. Such a rarity offers only a dangerous clinical pitfall. A diagnosis of ovulation during amenorrhea must never be made without clear proof.

Likewise, in about 10 per cent of 392 infertile women, we[60] found evidence of anovulatory menstruation. In 50 per cent of this group of anovulatory patients (or about 5 per cent of the entire group of sterile women studied), such evidence was obtained by more than one biopsy — that is, flow from an endometrium still in the proliferative stage. This phase, as I have pointed out, indicates the presence in the ovaries only of active follicles and not of a functioning corpus luteum. The absence of this gland accounts for the fact that anovulatory menstruation occurs at widely varying intervals and not with the usually constant periodicity of the flow that follows the action and regression of a corpus luteum. Not only do normal postovulatory menstrual periods commonly recur at fairly constant intervals, but such catamenia are similar in the duration, quantity and quality of flow. On the contrary, the flowing that occurs with failure to ovulate is very variable in these details. For this reason, I think the term "aperiodomenorrhea," meaning irregular, immeasurable menstruation, is proper. I have no accurate figures, but I should guess that, in women between sixteen and forty-five years of age, failure of ovulation is reflected in aperiodomenorrhea at least three times as often as it is in amenorrhea. The latter, like the symptomatic syndrome of the menopause, usually indicates the failure not only of ovulation but also of appreciable growth of all but perhaps a very few follicles.

Induction of Ovulation

The means to stimulate ovulation should logically have reference to the normal physiologic activators of ovular and follicular maturation. Since comparatively little is known of the physiology of human ovulation, it is not surprising that efforts to evoke this phenomenon in women who suffer its failure are often in vain. Even when ovulation does follow certain procedures, one is usually unable accurately to determine the successful underlying process.

Thyroid Therapy

Results from thyroid medication are a good example of inexplicable consequent ovulation. In a small proportion of cases (perhaps not more than

5 per cent), ovulation follows the administration of as little as 1 gr. of the dried gland daily, even in patients whose basal metabolic rates are normal. Pincus[61] states that the thyroid *may* promote ovogenesis to a certain extent. Salter[62] cites evidence indicating that the thyroid gland is related to ova production in the bird.

Diet and Hygiene

Empirically, likewise, the relief is called for of anemia and the probably associated occult deficiencies of vitamins or minerals when ovulation fails, whether or not to the extent of amenorrhea. This should be the first attack on the problem. Although the condition is not so serious as the subclinical pellagra considered by McLester,[63] one should remember his advice that "the physician who would treat deficiency diseases cannot afford to be timid." It is therefore well to give relatively large doses, especially of the vitamins, when one is working on the theory that they may be missing. Physical and mental hygiene should not be neglected. Exercise, rest and equanimity are beneficial. Although the relation between emotional tone and ovarian function is not clearly understood, it is frequently apparent, and an effort should be made to resolve what mental conflicts one can discover.

Hormones

During the last few years, endocrinologic attacks on anovulation in the human female have been suggested by attempts on laboratory animals that were relatively successful.

Chorion hormone. Experiments were undertaken with the chorion or anterior-pituitary-like hormone, extracted from the urine of pregnancy. This evokes maturation and ovulation in even the immature rat and mouse, and so surely elicits these phenomena in the isolated rabbit doe as to establish the dependable Friedman test for human pregnancy. This hormone, however, under any of its many pharmaceutical titles, completely fails to produce the desired result in human patients. Geist and his co-workers,[64, 65] Hamblen[66] and others agree that it is useless for this purpose in the clinic. Hartman[67] likewise found it to yield "far from promising" results when tested on the laboratory primate, the macaque monkey.

Pituitary extract. Trials were also made with extracts of the anterior lobe of the pituitary gland of sheep. Zondek and Aschheim[68] and Smith and Engle[69] originally demonstrated the dependence of follicular maturation on the anterior hypophysis. Pincus[70] marshals much laboratory data on the rabbit to show that this gland materially influences the ripening of ovum and follicle. Unreported trials with a commercial preparation of this material in my clinic failed utterly to accomplish anything among a group of anovulatory patients. Research is now in progress with an improved extract from sheep's anterior hypophysis, which is giving encouraging results, but only in follicular growth and in the production of uterine bleeding.

Serum gonadotrope. Recently, there came to hand the potent follicle-stimulating hormone from the serum of pregnant mares. Davis and Koff,[71] Siegler and Fein[72] and Hall[73] had reported great success with it. Although we[74] tried many different dosages and sequences in 48 patients, our results convinced us that this hormone, too, was quite unsatisfactory as a maturing hormone for human follicles. The recent report of Geist and his associates[65] substantiates our findings.

Chorion hormone and serum gonadotrope. Hisaw, Greep and Fevold[75] showed that a critical proportion of follicle-stimulating and luteinizing hormones made juvenile female monkeys ovulate. Since the chorion hormone is predominantly luteinizing, and the serum gonadotrope is in laboratory animals almost always only follicle stimulating, it was hoped that a combination of the two in sequence or combined in various proportions would produce the desired result. Among 22 anovulatory patients given these hormones in different doses, combinations and sequences, not one gave evidence of ovulation.[74] Hamblen[66] reports greater success with such combined and cyclic forms of therapy. I still believe, on the basis of laboratory studies on animals, that a particular combination and sequence of chorion hormone and serum gonadotrope may prove satisfactory. A better way would be to regulate the patient's own glandular system, if one only knew how.

Estrogen. Zondek[76] and others have shown in animals that small doses of estrogen are stimulating to the anterior hypophysis, which responds by increasing its maturation influence on the follicle. Greep's[77] preservation of the corpora lutea of pregnancy, by injection of estrogen in rabbits from which both the hypophysis and the uterus had been removed, suggests that the mediation of the hypophysis is not always necessary.

Similarly, in human beings, repeated small doses of estrogen occasionally seem to exert a stimulating effect on the ovaries. Larger doses inhibit the pituitary gland, and if given daily for three or four weeks, commonly prevent ovulation in the regularly ovulating woman. Estrogen, then, is a

means not to be depended on, but one that apparently causes no permanent damage and in small doses may occasionally support follicular growth. Better results from pituitary gonadotrope may be obtained if small doses of estrogen are given simultaneously. The dosage must be nicely adjusted to the individual patient, for surely estrogen inhibits follicular growth if given in large quantities.[78]

X-Ray

In 1935, Mazer and Spitz,[79] in a report of their own work, gave utterance to the scattered experiences of many other clinicians by stating that so-called "stimulating doses" of x-ray would bring about ovulation in approximately 50 per cent of patients with amenorrhea, and would regulate (possibly by establishing ovulation) the menstrual flow of women suffering from aperiodomenorrhea — dysfunctional uterine bleeding. These results were confirmed in a later series of cases by Mazer and Baer.[80] Rutherford[81] analyzed the cases treated in my clinic, and likewise showed that ovulation occurred in about 54 per cent of the anovulatory patients whose ovaries were exposed to 50 or 60 r three or four times at weekly intervals. This treatment, I believe, should be kept as a last resort. The x-ray is not stimulating; it is destructive. It causes atresia of follicles from the more advanced to the youngest, according to the degree of exposure. The subsequent ovulation in the favorable cases is commonly attributed to the removal of a follicular influence that inhibited the pituitary gland. In some of the unfavorable cases, it may merely fail to do this, but it possibly also has a deteriorating effect on the growth impulse of the germinal epithelium, which thereafter may fail to produce any new oocytes, or to produce normal ones that can mature. From the uniform results of geneticists,[82, 83] one may be sure that even though ovulation is effected, the genes of the entire germinal epithelium thus exposed are changed; and one may well fear for the results in progeny when two germ cells, both descended from irradiated epithelium, are combined in the third or fourth generation. This may not seem an imminent consideration, but I now believe it should be one, and that x-ray treatment, although an attractive escape from a therapeutic morass, should therefore be avoided if possible.

* * *

It will be seen from the foregoing that I consider the hormonal treatment of anovulation to be definitely in a barely encouraging experimental stage. The first attack should be by copious use of hygienic and dietary measures, supplemented by small doses of thyroid and very small doses of estrogen. An improved pituitary extract may be forthcoming. If available, this should be added to the other measures, alone or in conjunction with chorion hormone, in nicely timed injections. X-ray therapy should serve as a last resource. My observation of the stubborn anovulators, especially of the amenorrheic type, leads me to believe that more careful attention to diet and hygiene during the pediatric years might prevent much gynecologic difficulty. Studies directed to the frequency of ovarian dysfunction in antecedents and relatives of patients exhibiting this derangement might also prove helpful, by establishing an inheritable factor.[84]

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

ANTE-MORTEM AND POST-MORTEM RECORDS AS USED IN WEEKLY CLINICOPATHOLOGICAL EXERCISES

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

CASE 27491

PRESENTATION OF CASE

A sixty-three-year-old locomotive engineer was admitted to the hospital because of painful and difficult urination, and aching and swelling in the right forearm.

Two years before entry, the patient began to have nocturia. After a year, the stream became small and difficult to start, and urination was quite painful. A local physician catheterized the patient periodically thereafter, and told him that he had "chronic inflammation" of the urethra and an "enlarged" prostate. Four months before entry, he began to have a steady ache in the right wrist. He noticed that when he was at work in his locomotive the ache was worse when he rested his right forearm "flat" than when he rested it on its ulnar surface. Two weeks before entry, the right wrist began to swell.

The patient's mother had died of "cancer of the liver." As a youth, he had a "soft chancre" and a bubo in his groin. About forty years before entry, he suffered a severe burn of his right leg. On two subsequent occasions, he fractured this leg. He dislocated his left wrist once and his right wrist twice, the last accident occurring ten years before entry. He had always had a very dry, easily chapped skin. He had had a chronic morning cough, with small amounts of sputum, for fifteen years before entry.

He had been seen in the hospital fourteen years prior to the present admission, because of tremor, dyspnea and palpitation of a year's duration. The thyroid gland was enlarged and firm. The basal metabolic rate was + 40 per cent. Auricular fibrillation was present, and responded to quinidine therapy. A subtotal thyroidectomy was performed (pathological diagnosis: hyperplasia), and the patient discharged improved.

On the present admission, examination showed an obese, apparently healthy man, with unremarkable heart, lungs and abdomen. The prostate gland was very small and of fibrous consistence, without palpable nodules. There was a firm swelling in the region of the head of the right radius, with redness of the overlying skin and local heat. The skin, as a whole, was dry and scaly.

The temperature, pulse and respirations were normal; the blood pressure was 140 systolic, 85 diastolic.

Examination of the blood showed a white-cell count of 9400 with 67 per cent polymorphonuclears, and a red-cell count of 4,280,000 with 13 gm. hemoglobin. The blood Hinton reaction was negative. The blood calcium was 9.3 mg., and the phosphorus 3.1 mg. per 100 cc.; the phosphatase was 3.5 Bodansky units. The nonprotein nitrogen was 12 mg. per 100 cc., and the urine showed a + test for albumin.

A roentgenogram of the right wrist showed a number of areas of destruction in the distal extremity of the radius, with some periosteal formation of new bone on the margins of the adjoining part of the shaft. Very little atrophy was present. Both medulla and cortex were involved, and there was definite soft-tissue swelling posterior to the involved joint. Roentgenograms of the pelvis and the chest were negative.

On the ninth hospital day, an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. GRANTLEY W. TAYLOR: This is a confusing story, and I think we are not going to get far with it until we see the x-ray films. Then it is going to be a matter of guessing the diagnosis. May we see the x-ray films first?

DR. JAMES R. LINGLEY: This is the area of destruction, rather a lobular area, in the lower extremity of the radius. In the lateral view, one can see destruction of the cortex posteriorly and definite thickening and edema of the soft tissues.

DR. TAYLOR: Somewhere in this interpretation, it speaks of the involved joint. That is just a loose method of expression, I take it. You do not see anything in the films to show that there is an involved joint?

DR. LINGLEY: No.

DR. TAYLOR: On reading the history, I became progressively more confused and gave thought to a number of things that I might have to consider when I saw the pictures. The patient dislocated his wrists some time before admission. I do not know what happened, but such dislocations are extraordinarily rare. I wondered if he had old traumatic arthritis, with absorption and new-bone formation around the joint, especially because of the allusion to the joint in the interpretation. Very much against that diagnosis are the facts that no atrophy was observed by x-ray study, and that motions were carried out with apparently adequate range. Then, I considered the question whether he had punched-out areas

in the bone near the joint, due to gout. There was nothing in the history either for or against it.

The question of infection arose very strongly in my mind, because of the urologic difficulties — chronic urethral discharge, painful urination and a history of a soft chancre and bubo; it seemed to me that we might reasonably consider the possibility of gonorrheal arthritis in this case.

Syphilis of the bone, Charcot joint or gumma, it seems to me, reasonably enters into the possible diagnosis. However, the negative blood Hinton reaction, the fact that this lesion was painful and the fact that it was not in a weight-bearing joint all argue against anything like a Charcot lesion.

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Tuberculosis of the bone is very unusual at this age, but it may occur, especially in the vicinity of a joint. Pyogenic osteomyelitis is also a very reasonable possibility. Against it are the normal chart, the normal white-cell count and the lack of a preponderance of polymorphonuclears in the differential count.

Then we move on to the consideration of neoplastic diseases of the bone. The patient was in an age group in which such diseases as Ewing's tumor and osteogenic sarcoma are rare. The latter occurs in this age group almost exclusively in association with very extensive Paget's disease of the bone, of which we have no evidence. The reticulum-cell-sarcoma type of lymphoma, which has recently been established as a clinical entity, is a rather capricious disease in the sense that we have not seen enough cases to say what its usual habits are, or what clearly defined characteristics it has on clinical observation or x-ray examination. It is something that must be considered and is hard to rule out. Hodgkin's disease of the bone, almost invariably associated with Hodgkin's disease elsewhere, also gives a confusing x-ray appearance and is sometimes very difficult to identify. A single plasma-cell myeloma should definitely be considered. I believe it is very unusual in a location of this sort. No mention is made of the serum protein or the possibility of Bence-Jones protein in the urine, or any of the other characteristics on which that diagnosis could reasonably be based.

Finally, we come to metastatic neoplasms. Metastases are very unusual below the elbows and knees, but they may occur. If we consider the diagnosis of metastases, we must find a primary focus of disease. We have no evidence of a primary focus anywhere. The concomitant problem this patient presents is urinary-tract difficulty. The small prostate, one that is not nodular, does not suggest a neoplasm. The negative spine and pelvis plates practically rule out the possibility of metastases.

To all these possibilities, there are good objections, but it seems to me that we must at least have "got warm" somewhere in this rehearsal of the list of diseases. I should think that the objections to pyogenic osteomyelitis are less convincing than those for most of the other conditions. We have seen a number of cases of pyogenic osteomyelitis in which there was no elevation of temperature and in which there was no particular change in the leukocyte count, which is unusual. Let us consider that diagnosis in the light of the x-ray findings. We have surprisingly little new-bone formation. It is described in the notes, but is not a conspicuous feature in the study of these x-ray films. We do have rarefaction in the bone, but without surrounding condensation of bone, which is commonly seen around the Brodie's-abscess type of chronic, indolent bone infection. In favor of pyogenic osteomyelitis are soft-tissue swelling, which is not definitely a tumor, and edema of the tissues, which is less commonly found in conjunction with neoplasm than with inflammatory conditions. It seems to me that pyogenic osteomyelitis is the most probable diagnosis. I should definitely entertain, in the background, however, the possibility of primary malignant neoplasm.

Dr. Lingley can probably contribute to this discussion by further comment on the x-ray films, considering the diagnostic problem that they present; the diagnosis in this case is almost entirely a problem for the roentgenologist and pathologist.

Dr. Lingley: As Dr. Taylor has remarked, the presence of edema of the soft tissues is an important finding in ruling out a tumor in this case. We very rarely see either a malignant or a benign tumor with such definite edema as we have in this case. I think that the presence of edema immediately puts the lesion in the infection group. The question now comes up whether it is pyogenic infection, syphilis or tuberculosis. I think the roentgenologic appearance fits very beautifully a pyogenic infection. There is destruction, with some periosteal new-bone formation. Tuberculosis is almost always entirely destructive. There can be new-bone formation in tuberculosis, but in this case there is more than one would expect if it were tuberculous. Syphilis is a definite possibility. The type of periosteal reaction in this case could be classed as the lacelike type of periosteal bone formation that one sees in syphilis. I should place pyogenic osteomyelitis as the first diagnosis, and syphilis as the second.

DR. ALLEN G. BRAILEY: Is the fact that the phosphatase level was normal of any help?

DR. TAYLOR: I should think not. Dr. Fransceen has studied these reactions. A high phosphatase level is evidence of osteoblastic activity. We may see a very high one in diseases like Paget's disease, and with some of the osteogenic sarcomas. On the other hand, it may be fairly low in cases of bone sarcoma, especially when there is not a great deal of osteoblastic activity. The low figure in this case might be taken as evidence against osteogenic sarcoma, but I do not believe that it would be indisputable evidence. Some of our osteomyelitis cases have had high phosphatase levels.

DR. CLIFFORD C. FRANSEEN: I agree entirely. The normal phosphatase and the absence of evidence of new-bone formation fit together. That is all one can say.

CLINICAL DIAGNOSIS

Osteomyelitis?
Lymphoma?

DR. TAYLOR'S DIAGNOSIS

Pyogenic osteomyelitis.

ANATOMICAL DIAGNOSIS

Chronic osteomyelitis of radius (*Staphylococcus aureus*).

PATHOLOGICAL DISCUSSION

DR. TRACY B. MALLORY: This patient was operated on, and when the cortex was incised a free flow of pus was obtained. The material curetted from the cavity showed chronic inflammation and no evidence of neoplasm. Cultures of the pus showed *Staphylococcus aureus*.

A PHYSICIAN: What about the urinary tract?

DR. MALLORY: I know nothing more about that. The patient is still convalescing.

CASE 27492

PRESENTATION OF CASE

A seventeen-year-old Portuguese-American student was admitted to the hospital because of swelling of the left leg.

The patient was well until about six months before entry, when he noticed painful swelling of his right shin. He thought that he had struck the shin against hard objects on several occasions. The swelling gradually increased. After a few months, a local physician was consulted. After a roentgenogram of the leg was taken, a biopsy was requested and refused. Several months later, the patient came to the hospital.

On admission, the patient appeared healthy; the heart, lungs and abdomen were normal. There was a diffuse, bony hard, fusiform swelling on the posteromedial aspect of the left tibia, involving the middle third of the shaft, continuous with the normal portions of the shaft at its margins.

The temperature, pulse and respirations were normal; the blood pressure was 120 systolic, 70 diastolic.

Examination of the blood showed a white-cell count of 13,200 with 74 per cent polymorphonuclears, and a red-cell count of 5,070,000 with 85 per cent hemoglobin. The blood calcium was 11.6 mg. and the phosphorus 3.8 mg. per 100 cc., and the phosphatase was 6.3 Bodansky units. The blood Hinton reaction was negative. The urine was normal. A tuberculin test was negative in a 1:10,000 dilution.

A roentgenogram of the left leg showed a fusiform thickening of the tibia, at the junction of the upper and middle thirds. The periosteum in this area was markedly thickened, and in one or two places there was slight roughening of the periosteum, with some destruction. There was very slight soft-tissue thickening, superimposed. A cavity, measuring 1 by 1.5 cm., situated at the base of the region of periosteal formation of new bone, was visible only on a film that had been much overexposed.

On the seventh hospital day, an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. THOMAS ANGLEM: May we see the x-ray films?

DR. JAMES R. LINGLEY: Here we see the area of fusiform thickening described, which is due mainly to the gross thickening of the cortex on the posterior margin of the shaft. In the overexposed film, there is one small linear area of rarefaction about 1.5 cm. in length within the area of new-bone formation, but I cannot demonstrate it with this light. There is no surrounding soft-tissue mass, and no edema of the soft tissues.

DR. ANGLEM: There is very little in this story that is of any diagnostic aid. It seems to me, as in the last case, that the diagnosis rests on the interpretation of the x-ray films. The essential finding in the history is a story of progressive swelling of the tibia for six months, associated with some pain. At the time of examination, the boy was apparently still in good general health, with normal temperature, moderate leukocytosis —13,200— and a slight elevation in the serum-phosphatase level; otherwise, the findings were essentially negative. We get some assistance from

consideration of certain negative findings. The tuberculin test was negative in a 1:10,000 dilution. This, coupled with the x-ray picture, which has none of the usual characteristics of a tuberculous bone lesion, I think, permits us to rule out tuberculosis. The blood Hinton reaction was negative; however, this lesion conceivably could be syphilitic on the basis of its x-ray appearance. It shows a degree of condensation in the cortical bone consistent, I think, with syphilitic osteitis, and the area of destruction might also be explainable on the basis of a syphilitic lesion. However, it would be very hazardous to make a diagnosis of bone syphilis in the presence of a negative blood Hinton reaction. I believe that we can disregard syphilis as a possibility.

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The diagnosis comes down to a choice between a low-grade infectious process of bone and malignant tumor. Of the malignant tumors, I think only two need be considered seriously — endothelioma of bone and osteogenic sarcoma. The position of this lesion is typical of what we usually see in Ewing's sarcoma, but the other features of the disease are lacking. It is unusual to see this degree of sclerosis or condensation of bone in Ewing's tumor, and the sharply localized small area of destruction is not the usual picture. We can rule out Ewing's sarcoma.

Osteogenic sarcoma usually occurs in the metaphysis and is relatively uncommon in the midshaft of the bone. Nevertheless I think that it must be considered a possibility. On the whole, this picture does not seem to me to be the picture of osteogenic sarcoma. The usual classic features of the disease are lacking. There is no reactive triangle that I can make out. The small area of destruction seems to be sharply localized, and the area of reactive bone is much more diffuse and spreads around the entire circumference of the bone rather than being limited to the area in which the destruction is apparent.

A low-grade infection of the bone seems the most likely possibility here. As in osteogenic sarcoma, it also occurs most commonly in the metaphysis rather than in the shaft, but in contrast with the usual form of acute hematogenous osteomyelitis, which occurs predominantly in the very young, the subacute and chronic forms occur very frequently in the shaft and are relatively common in older children and young adults, the age group in which this patient falls. The absence of any definite soft-tissue swelling and the absence of tumor are against infection. Nevertheless, in any extremely low-grade process existing for a long time, it is possible to have infection without any superimposed soft-tissue swelling or edema. The sharply localized punched-out area in the cortex seems to me to suggest, from the x-ray appearance, a cortical abscess more than an area of destruction from a malignant tumor, and the periosteal reaction in the surrounding bone is consistent with a low-grade infectious process. I should say that the first and most likely possibility in this case is low-grade infection, — osteomyelitis, — with osteogenic sarcoma as a definite possibility.

Dr. Tracy B. Mallory: Dr. Lingley, do you want to discuss the radiologic aspects further?

Dr. Lingley: I agree with Dr. Anglem in his diagnosis. I think the picture is very characteristic of Garrè's[1] sclerosing osteomyelitis. It is a low-grade infection that has been present for a long time, producing dense, well-organized new bone. The character of the new bone is very much against any type of tumor. Ewing's sarcoma is the most likely tumor in a location involving a large area of the shaft, but there is no onion-peel formation and not enough destruction, and the new bone is too dense and well organized.

Dr. Grantley W. Taylor: In one x-ray film, there is a suggestion that there has been distortion of the weight-bearing line of the tibia. If that is a correct interpretation, it seems to me that it is a finding we have observed in a number of cases of osteomyelitis in the shaft of the bone: definite overgrowth on one side, with a slight distortion of the axis of the bone.

Clinical Diagnosis

Osteoid osteoma.

Dr. Anglem's Diagnosis

Low-grade osteomyelitis.

Anatomical Diagnosis

Osteoid osteoma of tibia.

Pathological Discussion

Dr. Mallory: Shortly after admission, the patient was seen in the Tumor Clinic, where the consensus was that this was an inflammatory lesion, because of the comparative lack of symptoms, and that biopsy was not indicated. It was suggested that the x-ray films be reviewed again. The patient was later seen at the surgical grand rounds, where, in contrast, biopsy was advised. Eventually it was done. A considerable section of the cortex was removed, cutting down to and including the minute area of rarefaction, which Dr. Lingley believed was there but could not satisfactorily demonstrate in this light. The histologic section has a line of dark red across it, 1.0 cm. in length and 0.4 cm. in width, which corresponds

very closely to the size of the lesion Dr. Lingley saw. The area shows decreased calcification, and is made up largely of small, somewhat atypical trabeculae of osteoid tissue, very imperfectly calcified. Between the osteoid tissue are bands of very vascular fibrous tissue containing many foreign-body giant cells or osteoclasts, if one prefers to call them that. The picture suggests what one might expect in a benign giant-cell tumor that was undergoing spontaneous healing, as if it all began to fill in with osteoid tissue. The surrounding cortical bone is extremely dense but shows comparatively little proliferative activity. Its marrow spaces are fibrous rather than fatty.

This is a clear-cut example of a lesion originally described by Jaffe[2] and given the name "osteoid osteoma." He and Lichtenstein[3] have recently reported a series of 33 cases. They consider the x-ray appearance rather characteristic, and they were able to diagnose a fair proportion of the cases before biopsy on the basis of the x-ray findings. If the lesion is seen in the early stages, a local area of rarefaction is all that is obvious, but in the later stages a marked thickening of the cortex around the region is quite characteristic, as in this case; still later, the focus itself may become densely calcified and sometimes appears as a focus of increased rather than decreased calcification. The appearances can therefore be quite variable. Do you believe that their description is adequate for one to recognize these cases, Dr. Lingley?

DR. LINGLEY: I knew the pathologic diagnosis before I discussed this case, and I still believe that the appearance closely simulates sclerosing osteomyelitis. We have had two cases of osteoid osteoma of the spine, and they showed exactly the same increased density in the surrounding bone — in one case, enough to make us think of meningioma. It is a rare condition that we must keep in mind when we have a case simulating sclerosing osteomyelitis.

DR. TAYLOR: This is not simply a new name for Garrè's type of osteomyelitis, is it?

DR. MALLORY: I think we can be reasonably certain that it is not. None of Jaffe and Lichtenstein's cases showed febrile episodes. Cultures, when taken, were uniformly sterile, as in this case. There is no histologic evidence of infection. Like so many lesions, when one begins to recognize them, they are not so rare as they are supposed to be. We have seen several cases in this hospital, although not enough yet to have a clear-cut idea of the clinical picture.

DR. CLIFFORD C. FRANSEEN: What is the recommended treatment?

DR. MALLORY: So far, the lesion has been excised in all recognized cases. This results in prompt relief of pain, and no recurrence. I have found no mention of attempted x-ray treatment. It is rather characteristic that the lesion appears in late adolescence and early adult life. Most cases are in the late teens or early twenties.

DR. BRAILEY: What is the course when the tumor is not treated?

DR. MALLORY: So far as Jaffe and Lichtenstein know, the patients continue to have pain until they insist that something be done for them.

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INSTRUCTION IN FIRST-AID CARE

An article appearing elsewhere in this issue of the *Journal* calls attention to the importance of instructing laymen in first-aid care, not only because of the value of such knowledge in handling the possible civilian casualties of war but also because of its usefulness in giving proper *immediate* care to the millions of people who are injured each year in automobile and industrial accidents.

Various courses have been sponsored by the American Red Cross, and although over three million certificates have been issued since 1910, it is only within the last two years that the population as a whole, stimulated by the national emergency, has become properly appreciative of what it can contribute if adequately trained in first-aid care. Interest has been largely promoted by the training of thousands of instructors by the American Red Cross, who, in turn, have conducted the classes for civilian defense workers, employees of industrial plants and business establishments, service men and those employed by various local and state governmental bureaus.

Many physicians, unfortunately, seem to have been rather indifferent to this effort — some because of a belief that first-aid care cannot be properly given by a layman and others because they are ignorant of what such care comprises. There is no doubt, however, that many of the procedures with which the trained layman is familiar may result in the saving of life or the prevention of severe and permanent crippling, and all physicians should familiarize themselves with the methods of first-aid care and should, if possible, register with their local Red Cross chapters as instructors in standard or advanced first-aid courses.

A booklet, *Advanced First Aid for Civilian Defense*, has recently been prepared by the American Red Cross in collaboration with the Medical Division of the Office of Civilian Defense. This ten-hour course is intended for the personnel of emergency medical field units, for air-raid wardens and for members of other civilian-defense groups. Although alone inadequate for nonmedical workers, it furnishes minimum instruction when supplemented by repeated drilling under competent supervision. Physicians who are members of emergency medical field units should conduct the instruction and obviously should be thoroughly acquainted with the contents of the booklet, copies of which can be obtained from the First Civilian Defense Region, 101 Milk Street, Boston.

CHRISTMAS SEAL CAMPAIGN AND NATIONAL DEFENSE

Because of the national emergency, the forthcoming Christmas Seal Campaign of the National Tuberculosis Association merits even greater attention and more generous support than the campaigns of other years. Each week brings the European conflict closer. The recent sinkings of American ships in the waters of the Western Hemisphere emphasize the need for more than a

vague and half-hearted — and therefore fumbling — program of defense. A united and determined nation, willing to sacrifice temporary comforts and luxuries, must be ready to meet a very real threat. The question of *when* defense is to be achieved now holds little more than academic interest; the question of *how* is all-important.

The crux of the defense effort is good health: a healthy and expertly trained army and navy can be equipped only with the arms produced by industrial workers, who must be protected from sickness; a healthy general population must encourage and support the military and the industrial army — the morale of the whole nation could easily be weakened by widespread disease. Thus, tuberculosis, which still ranks seventh as a cause of death in America and is still the chief killer in the age group that is most vital for national defense, must be eliminated not only from the armed forces and workers in industry, but also from the ranks of those who must endure the restrictions, privations and dislocations of a wartime economy.

The death rate from tuberculosis has been cut 75 per cent since the first sale of Christmas Seals, in 1907. But until the disease has become a curiosity of medical history, — that is, until the death rate has been cut 100 per cent, — there must be no lag in the fight against it; medical knowledge is at present sufficient to stamp it out, but a vast expenditure of money and energy must be available before that goal can be attained. Organizations like the National Tuberculosis Association can function only with the support of the public and the medical profession.

The Christmas Seal Campaign this year presents a double challenge to patriotic and humanitarian impulses: by contributing generously, laymen and physicians can help free the armed forces and the civilian population of tuberculosis, and at the same time they can achieve progress toward the goal of complete eradication, so that in the days of peace a healthy nation can enjoy the liberty, happiness and prosperity it must now fight to preserve.

MEDICAL EPONYM

Legg-Calvé-Perthes's Disease

This condition was first described as an entity by Arthur T. Legg (1874–1939) when he was junior assistant surgeon at the Children's Hospital, Boston, in a paper read at the annual meeting of the American Orthopedic Association in June, 1909. The paper was published under the title, "An Obscure Affection of the Hip-Joint," in the *Boston Medical and Surgical Journal* (**162:** 202–204, 1910). The author reported five cases, with x-ray photographs, and said:

> . . . the following facts . . . are observed:
> (1) Age, five to eight years.
> (2) History of injury.
> (3) Limp.
> (4) Thickening about the neck of the femur.
> (5) Absence of pain.
> (6) Absence of constitutional symptoms.
> (7) Little or no spasm.
> (8) Absence of shortening. . . .
>
> We have considered a group of cases all presenting practically the same conditions . . . which are to my mind atypical of any condition heretofore described. . . . I make no claim to any definite conclusion.

Jacques Calvé, while assistant surgeon of the marine hospital at Berck, wrote a paper, entitled "Sur une forme particulière de pseudo-coxalgie greffée sur des déformations caractéristiques de l'extrémité supérieure du fémur [A Special Form of Pseudotuberculosis of the Hip, with Characteristic Deformities of the Upper Extremity of the Femur]," which appeared in the *Revue de Chirurgie* (**42:** 54–84, 1910). A portion of the translation follows:

> In the past three years, I have had the opportunity of seeing 10 cases of chronic arthritis of the hip that ran a distinctly typical course and were clearly defined both clinically and radiographically, not corresponding to any type previously described and at first considered to be coxalgia, from which they differed in several respects.
>
> As may be seen on reading the notes that we have given at the end of this article and from the examination of the radiographic pictures that accompany them, the chief characteristics of these arthritides are:
>
> (1) Signs of a reaction about the joint, running a chronic or subacute course and healing without any limitation of motion.
>
> (2) Bony deformities preceding these articular symptoms and persisting after their disappearance. These are:
>
> (*a*) Coxa vara.
> (*b*) Hypertrophy of the head of the femur.
> (*c*) Atrophy and lamellar deformity of the center of ossification of the head.
> (*d*) Complete absence of bony destruction. . . .

> These arthritides . . . occur in young subjects between the ages of three and one-half and ten years.

In 1913, Professor Georg Perthes (1869–1927), director of the surgical clinic at Tübingen, delivered an address, "Ueber Osteochondritis deformans juvenilis [On Osteochondritis Deformans in Young Persons]," which was published in the *Archiv für klinische Chirurgie* (**101:** 779–807, 1913). He stated that several observers had reported cases of this condition, mentioning his own observation in the *Deutsche Zeitschrift für Chirurgie* (**107:** 111–159, 1910), under the title "Ueber Arthritis deformans juvenilis [Concerning Arthritis Deformans in Young People]," but apparently was unfamiliar with Legg's description. He stressed the value of recognizing the nontuberculous nature of the condition. A portion of the translation follows:

> In this disease, which I should like to discuss here as "osteochondritis deformans of the hip in young persons," we are dealing with a peculiar wasting away of the upper epiphysis of the femur, which originates in a subchondral focus of destruction and is complete only after a course of some years. . . . After careful studies, and as the result of work done in company with my assistant, Dr. Schwarz, I have arrived at the opinion that in these cases we are dealing with a disease process fundamentally different from the arthritis deformans of adults, and also that the other conception which exists in regard to this condition, namely that it is a tuberculous affection of the upper femoral epiphysis, is not justified. We are rather dealing with a peculiar, unique process, which regularly leads to a characteristic clinical picture and apparently is self-limited.

A careful and detailed description of the condition follows, with case histories and x-ray pictures.

R. W. B.

MASSACHUSETTS MEDICAL SOCIETY

SECTION OF OBSTETRICS AND GYNECOLOGY*

Fatal Nausea and Vomiting in Pregnancy

A twenty-four-year-old primipara entered the hospital at the end of the third month, with a diagnosis of nausea and vomiting of pregnancy.

The history states that the patient had been vomiting practically everything for the four weeks before admission; her weight was 90 pounds, which represented a loss of about 40 pounds. On physical examination, the pulse was 140. There was some tenderness over the region of the liver. An icteric-index determination and liver-function test showed evidence of liver damage. The patient was given 10 per cent glucose solution intravenously, and four days later, it was decided that abortion should be induced. The cervix was dilated, a catheter inserted, and the vagina packed with gauze, in addition to 5-minim doses of pituitary extract every fifteen minutes for ten doses.

On the following day, the catheter and gauze pack were removed, and the fetus was passed spontaneously. Subsequently, the patient did not improve and, in spite of stimulation, died four days later. No autopsy was performed.

Comment. This case is evidence that, when poorly treated, the nausea and vomiting of pregnancy may still become pernicious and even result in death. Since this patient had had no medical care until she entered the hospital, her death is due solely to neglect on her own part.

Such patients die solely of starvation. Had the patient consulted a physician when the first distressing symptoms of nausea and vomiting appeared and had simple home remedies proved of no value, hospitalization should have been advised. The treatment then would have been rest in bed, sedation, intravenous glucose (2000 cc. a day), thiamin chloride intramuscularly in large doses and no food by mouth for several days. Small feedings through a Levine tube might have been necessary, but most patients whose condition does not become too serious recover without tube feeding.

The loss of weight from 130 to 90 pounds shows how poor this patient's general condition was when she arrived in the hospital. The pulse of 140 was another indication of the seriousness of her condition. Abortion, which was the only possible recourse, proved unavailing. Such deaths, when patients are intelligent and consult medical advice, are absolutely unnecessary.

If the statement in the record that, after the catheter had been introduced and the vagina packed, 5-minim doses of pituitary extract were given every fifteen minutes for ten doses is correct, one can only be amazed. Small doses of the drug to stimulate labor after this method of abortion has been attempted may possibly do some good, but large doses are not only contraindicated but might cause harm. Ordinarily, there is no need of using pituitary extract when abortion is done in this manner.

*A series of selected case histories by members of the section will be published weekly. Comments and questions by subscribers are solicited and will be discussed by members of the section. Letters should be addressed to Dr. Raymond S. Titus, *Secretary*, 330 Dartmouth Street, Boston.

DEATHS

BLACKFAN—KENNETH D. BLACKFAN, M.D., of Boston, died November 29. He was in his fifty-ninth year.

Born in Cambridge, New York, Dr. Blackfan received his degree from Albany Medical College in 1905. He was pathologist and bacteriologist at the Albany Hospital from 1905 to 1907, instructor in pediatrics at the Polyclinic Hospital, Philadelphia, in 1910 and 1911, and assistant at Washington University School of Medicine, St. Louis, in 1911 and 1912. From 1912 to 1918, he taught at Johns Hopkins University School of Medicine, where he was associate professor of pediatrics from 1918 to 1920. He was professor of pediatrics at the University of Cincinnati College of Medicine from 1920 to 1923, and from that time until his death was professor of pediatrics at Harvard Medical School. He was chief of the medical staff at the Children's Hospital, and was associated with the Infants' Hospital. He was a member of the American Academy of Pediatrics, director of the American Child Health Association, and a fellow of the Massachusetts Medical Society and the American Medical Association.

He is survived by his widow and a son.

LYON—FREDERICK D. LYON, M.D., of Cambridge, died November 27. He was in his seventy-third year.

Dr. Lyon received his degree from Harvard Medical School in 1896. He was a former member of the Massachusetts Medical Society.

DEFENSE ACTIVITIES

UNITED STATES ARMY

The following medical officers entered on active duty between November 15 and 22, 1941:

BEGG, CHARLES F., 1st Lieut., of Providence, Rhode Island; Station Hospital, Camp Edwards, Massachusetts.

DEL CAMPO, DANTE, 1st Lieut., of Lynn, Massachusetts; Westover Field, Massachusetts.

GLENDY, ROBERT E., Capt., of Newton, Massachusetts; Station Hospital, Fort Banks, Massachusetts.

JADOSZ, FRANK C. J., 1st Lieut., of Providence, Rhode Island; Army Air Base, Bangor, Maine.

MORRISON, JONATHAN I., 1st Lieut., of Waban, Massachusetts; Westover Field, Massachusetts.

STARBUCK, GEORGE W., 1st Lieut., of Boston; Station Hospital, Camp Edwards, Massachusetts.

WALKER, DONALD A., 1st Lieut., of Worcester, Massachusetts; Army Air Base, Bangor, Maine.

CIVILIAN DEFENSE

X-RAY FACILITIES

The Medical Division of the Massachusetts Committee on Public Safety requests that all who operate private x-ray laboratories register with the committee the types of machines they operate, including the current necessary, with additional advice whether, in the event of a national emergency, they would be willing to have their machines moved to hospitals for public use. This information will, of course, be kept confidential, and no action will be taken without consultation with the owners. Communications should be addressed to Dr. Elliott C. Cutler, medical director, Massachusetts Committee on Public Safety, 18 Tremont Street, Boston.

RADIUM

In England, when an alert is sounded, all who possess radium are required to lower it into a well or pit about 50 feet deep, to do away with the danger that would occur should radium be scattered about in public places. All who possess radium should take some precaution for its proper disposition in the event of bombing.

REGIONAL MEDICAL OFFICER

Mayor F. H. LaGuardia, director of the Office of Civilian Defense, Washington, D. C., recently announced that Dr. Allan M. Butler, of Boston, had been commissioned senior surgeon in the Reserve of the United States Public Health Service and had been called to active duty as regional medical officer in the First Civilian Defense Region, with headquarters in Boston. The area of jurisdiction corresponds with that of the First Corps Area of the United States Army.

MISCELLANY

AMERICAN MEDICAL ASSOCIATION BROADCASTS

"Doctors at Work," the dramatized radio program broadcast by the American Medical Association and the National Broadcasting Company, will go on the air for its second season on Saturday, December 6, from 5:30 to 6:00 p.m., E. S. T. The program is broadcast widely from the more than seventy-five stations affiliated with the Red Network of the National Broadcasting Company and is heard from coast to coast.

Last year, the broadcast was a serialized story dealing with the experiences of a fictitious but typical American boy choosing medicine for his vocation and proceeding to acquire the necessary education and hospital training for the private practice of medicine. Interwoven with the personal story of young Dr. Tom Riggs and his fiancée, Alice Adams, was the romance of modern medicine and how it benefits the physician's patients.

The new series of broadcasts will resume where last year's story left off, namely, with the marriage of Tom Riggs and Alice Adams, and the subsequent life of a young physician and his wife at the time of a national emergency in a typical, medium-sized, American city.

NOTE

Dr. Russell F. Sullivan has been appointed professor of orthopedic surgery at Tufts College Medical School. He is at present visiting surgeon at the Boston City Hospital.

CORRESPONDENCE

ELIGIBILITY FOR SUBSCRIPTION TO MEDICAL-SERVICE PLANS

To the Editor: Differences of opinion exist among both laymen and physicians regarding the financial groups to which a prepayment medical-service plan should be available. In a discussion of this subject, the difference between voluntary and compulsory medical-service plans should be kept clearly in mind. This letter concerns itself only with voluntary plans.

Some believe that the Society's prepayment medical-service plan should apply only to the so-called "medically indigent," although it is generally conceded that it is difficult to define medically indigent because so many factors, such as size of the family and character of the ill-

ness, enter into the problem. Limitation of service to this group would mean that the subscribers would be made up chiefly from those who at the present time receive their medical care wholly or in part through institutions supported by taxation or private philanthropy. Students of these plans say that past experience shows that individuals in this group are unable and unwilling to pay such rates as are required to keep the plan from being a financial burden to physicians.

Others believe that service should be available to people in the income level above this charity group, which roughly includes those on the borderline of charity up to those in the income level that offers a moderate degree of financial security. Many in this group are anxious not to be objects of charity but still need some method of establishing their financial security by being able to budget for health as well as other expenses. Throughout the country, the medical profession obtains a substantial amount of its income from this group at the present time. Some physicians fear that permitting such persons to become subscribers would make further inroads on their incomes, which have been invaded in recent years by the free clinics because patients have been forced to have recourse to such clinics as good medical care has become more and more expensive. It must be admitted that, if this group is permitted to become subscribers, those physicians who participate will find themselves caring for certain patients who formerly were on a fee-for-service basis. However, in answer to this, it may be said that, where there have been sufficient subscribers and proper economy in the management of the plan, the funds from which physicians are paid have been sufficient to ensure a larger income for the same amount of work among this group than that on the fee-for-service basis. Furthermore, experience suggests that, under these medical-service plans, subscribers obtain more medical service than they are willing to avail themselves of on the fee-for-service basis. It is reasonable to expect that, if the medical-care plan is successfully launched, certain patients from charity or tax-supported clinics whose eligibility for such service is questionable will be returned to private practitioners. This will relieve the burden on moneys raised by taxation and the strain on private philanthropy.

Some laymen and physicians consider that prepayment medical-service plans should be available to all the population at the same rates, just as hospital-service plans are, or any other plans for budgeting the costs of services.

Experience shows that many persons object to subscribing to a medical-service plan to which only those with certain incomes are eligible. Some of these objectors fear that this indicates "cheap" medicine; others that it signifies class distinction and thus puts a stigma on them; and still others that there must be something wrong with the plan if their superiors in industry are not eligible. With a consideration for these various apprehensions and disapprovals among laymen and physicians, can a simple program be developed regarding who should be eligible to subscribe and on what basis?

This program should guarantee equal service to all subscribers and ensure proper compensation for all participating physicians. It must also be attractive to potential subscribers, because experience has proved that the success of these plans depends on the number of voluntary subscribers; in fact, failure to secure a sufficient number of subscribers on a voluntary basis has been a strong argument for those who favor compulsory health insurance.

Still others believe that, if the plan is open to people of all income levels, there should be a sliding scale of dues arranged in accordance with the subscribers' incomes. By careful adjustment of rates, it would probably not be necessary to eliminate as potential subscribers those in the higher income levels, because the rates in these levels would presumably be so high that few if any subscribers from this group would be interested. It has been suggested that under this arrangement a physician should receive more for the care of a subscriber who pays a higher rate than for the care of one who pays a lower rate. This seems fundamentally unsound because the amount of time and skill used by the physician toward any subscriber should be the same. The apparent injustice to the participating physician in not being able to obtain a substantial fee from the wealthy subscribers who formerly were patients on a fee-for-service basis might be equalized by the fact that the funds from which the doctors are paid would be substantially increased if any appreciable number of the subscribers came from the higher income levels, because of the higher rates such persons are charged. Thus, the physician's assured income for work done under the plan might be appreciably better than on the fee-for-service basis and the physician would still have an opportunity to add to his income by caring on a fee-for-service basis for those in the higher income levels who would not wish to budget for their medical service.

Such questions as these deserve the careful consideration of physicians. A presentation and tolerant discussion of various aspects of these problems in the *Journal* should contribute much to their ultimate satisfactory solution.

CHANNING FROTHINGHAM, M.D.

1153 Centre Street
Jamaica Plain, Massachusetts

REPORT OF MEETING

ROBERT BRECK BRIGHAM HOSPITAL

At a meeting at the Robert Breck Brigham Hospital on October 27, Dr. Carl C. Seltzer delivered a paper entitled "Anthropometry and Arthritis: The difference between rheumatoid and degenerative joint disease." The report was based on several series of male and female patients who were at the Robert Breck Brigham Hospital either at the time of the study or at some other time. Despite the small numbers involved, the statistics were found to be scientifically significant. The various arthritides were accurately defined, and all cases were clinically assigned to one or the other group.

A study of the racial background revealed that the two groups were composed fundamentally of a cross-section of the surrounding population except for insignificant variations. Had this not been so, the entire study might well have been invalidated. Scrutiny of the age distribution revealed an average of fifty-six years in the degenerative group as contrasted with thirty-seven years in those with rheumatoid arthritis. Since age might be expected to play a role, a comparison was made between the 12 youngest of the former and 12 of the latter group who were found to be of the same age group.

It was determined that, although body weight may be expected to vary during the course of the disease, the rheumatoid patients were about 30 pounds lighter when measured either by best or admission weight, regardless of age. Similarly, those with rheumatoid arthritis were found to have a greater absolute and relative arm span. The upper body measurements revealed that the rheumatoid patients had narrower shoulders and chest cir-

cumference. Furthermore, the greater chest circumference of the patients with degenerative arthritis was not explained by the weight difference. The same tendency was borne out in a measurement of the intercostal angles, which were markedly narrower in the rheumatoid group.

Examination of the lower torso showed that the rheumatoid patients were also smaller in this region than the other group except in relation to chest circumference. The upper extremities in the former group were shorter in over-all measurement as well as narrower, with very long, narrow hands and a relatively long forearm. The most significant finding in the lower extremities was the relatively small distal femoral intercondylar measurement in the degenerative class.

As a result of these and further detailed statistical analyses of anthropometric measurements and proportions, it was concluded that the patients with rheumatoid arthritis were markedly different in bodily physique from those with degenerative joint disease. These differences persisted even after allowances were made for the age discrepancies between the two groups and the effect of the disease on various parts of the body. On the whole, it appeared that the patients with rheumatoid arthritis were distinctly more linear; they were narrower in the shoulders, chest and hips, and smaller in many muscular circumferences. There were certain anthropometric proportions in which the two groups were so markedly divergent that their frequency distribution showed only slight overlap. Another point of particular interest was the discovery of a strong tapering of the lower extremity among the group with degenerative joint disease. It was found that this type of patient had absolutely and relatively larger bodily dimensions above the hips for the size of the knee and ankle joints.

It was also pointed out that the group with rheumatoid arthritis could be subdivided into several types of body build in which the linear element was fairly strong. The group with degenerative joint disease, on the other hand, consisted mainly of a single type, which was characterized by strong laterality, stocky build and a large-boned, large-muscled and highly pyknic habitus.

The discussion was opened by Professor Earnest A. Hooton, of Harvard University, who stated that it was a statistical miracle that the differentials showed up so clearly with such small samples. He believed that larger groups would undoubtedly corroborate these data and bring out additional smaller but significant data. The suggestion was made that these characteristic body types probably mirror physiologic tendencies, and that an attempt should be made to discover certain physiologic proclivities of normal subjects of the same body types. In general, race is considered of importance only in ruling out the few racial characteristics that might interfere with an evaluation of the individual as such.

Dr. Walter Bauer, of the Massachusetts General Hospital, expected the study to reveal merely a cross-section of the general population and found the results disturbing. In his experience, 100 per cent of people in the sixth decade exhibit evidence of degenerative arthritis. It was stated that there is some difference of degree, the hospital population being the worse and therefore probably representing a selected group.

In closing, Dr. Seltzer stated that there is indeed a mixture of types, which is most marked in the rheumatoid patients, who actually represent the random sample Dr. Bauer expected the degenerative group to be; the patients with degenerative disease are actually a very homogeneous group. Furthermore, an entirely independent study in another section of the country gave substantially the same results.

BOOK REVIEWS

Lectures on Diseases of Children. By Sir Robert Hutchison, Bart., M.D., LL.D., F.R.C.P., and Alan Moncrieff, M.D. Eighth edition. 8°, cloth, 471 pp., with 107 illustrations. Baltimore: Williams and Wilkins Company, 1940. $6.75.

This is not a systematic treatise on pediatrics. It is a transcript of clinical lectures covering, for the most part, the commoner diseases of childhood and such other maladies as manifest themselves more differently in the child than in the adult. A knowledge of general medicine by the reader is assumed, and there is perhaps more emphasis on treatment and general management than on diagnosis.

Obviously, this book is intended to supplement, not to supplant, the usual textbooks. And it contains a good deal of sound, though, to the pediatric specialist, elementary, advice. Of course, in the matter of nonspecific treatments, there often are, even among the ablest of therapeutists, enough grounds for disagreement, and some measures, commonly acceptable, apparently, to our British brethren, are in less favor in this country. Moreover, some of the drugs called for are, at least under the names used in this book, unfamiliar to us. Local trade names, at any rate in a volume intended for foreign consumption, should never be used. It is also to be noted that some of the x-ray reproductions are on so small a scale as to be well-nigh worthless.

The value of this book in England is attested by the fact that it has reached this eighth edition. Unfortunately, it will probably be of less utility here.

Accidental Injuries: The medico-legal aspects of workmen's compensation and public liability. By Henry H. Kessler, M.D. Second edition, enlarged and thoroughly revised. 8°, cloth, 803 pp., with 202 illustrations. Philadelphia: Lea and Febiger, 1941. $10.00.

With the advent of workmen's compensation laws, the medical and legal professions have been forced to develop a set of standards for appraising injuries. Kessler has summarized many of the isolated facts and experiences from the forty-eight states and has created a masterpiece of orderly thought on the numerous problems of accidental injuries.

In this book he gives a brief history of the progress in the field since Wisconsin passed the first state compensation law in 1911. There are many disparities in the present laws of the various states, but these will no doubt be erased as experience points the way to more workable and just legislation.

The introductory chapters are devoted to general considerations of workmen's compensation. There follows a section on specific injuries, which practitioners will find most helpful. Methods of examination, tests of function and evaluation of disability are considered for all types of injury and occupational disease. The facts and opinions collected here are encyclopedic in scope and can save much time in reaching a fair settlement. An extensive bibliography at the end of each chapter will be welcomed by those who wish more information on any specific subject.

(Continued on page x)